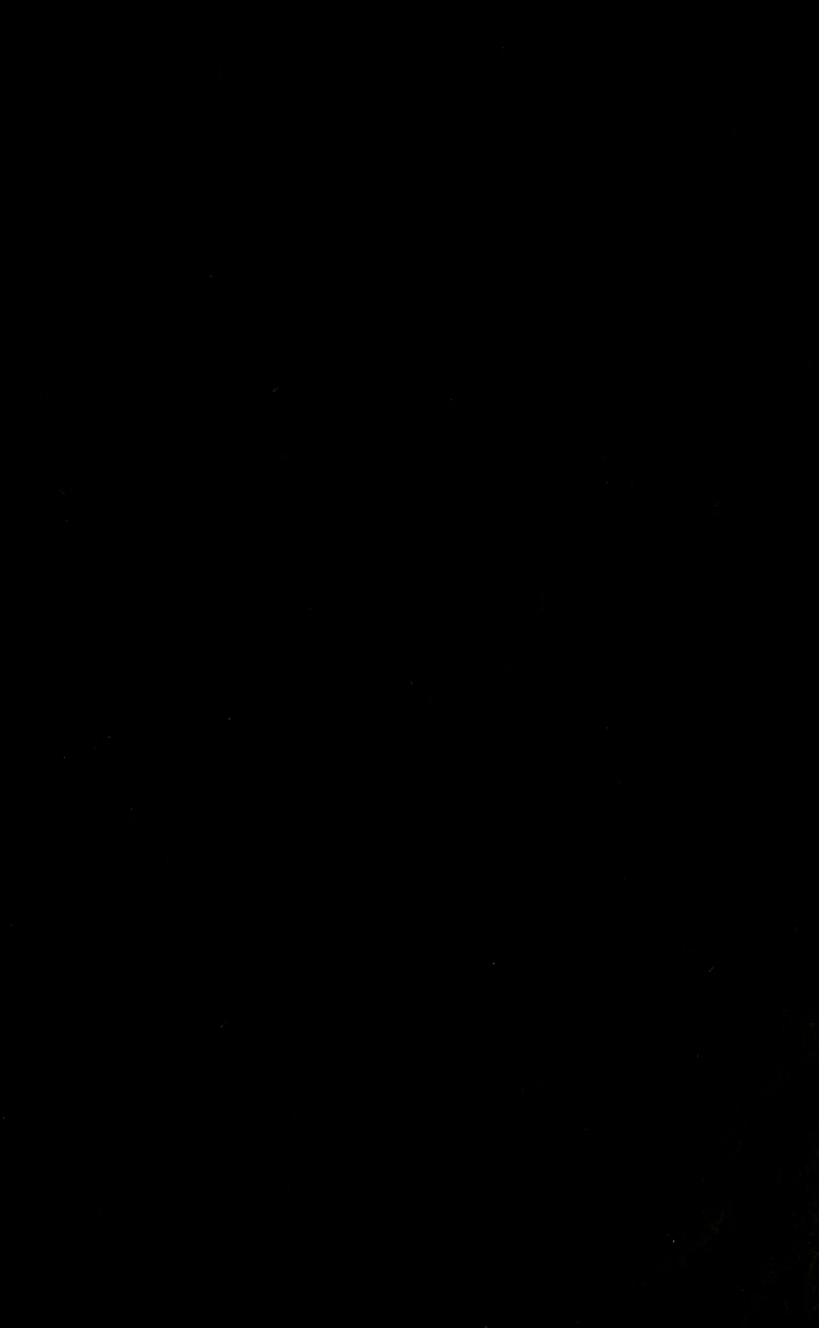
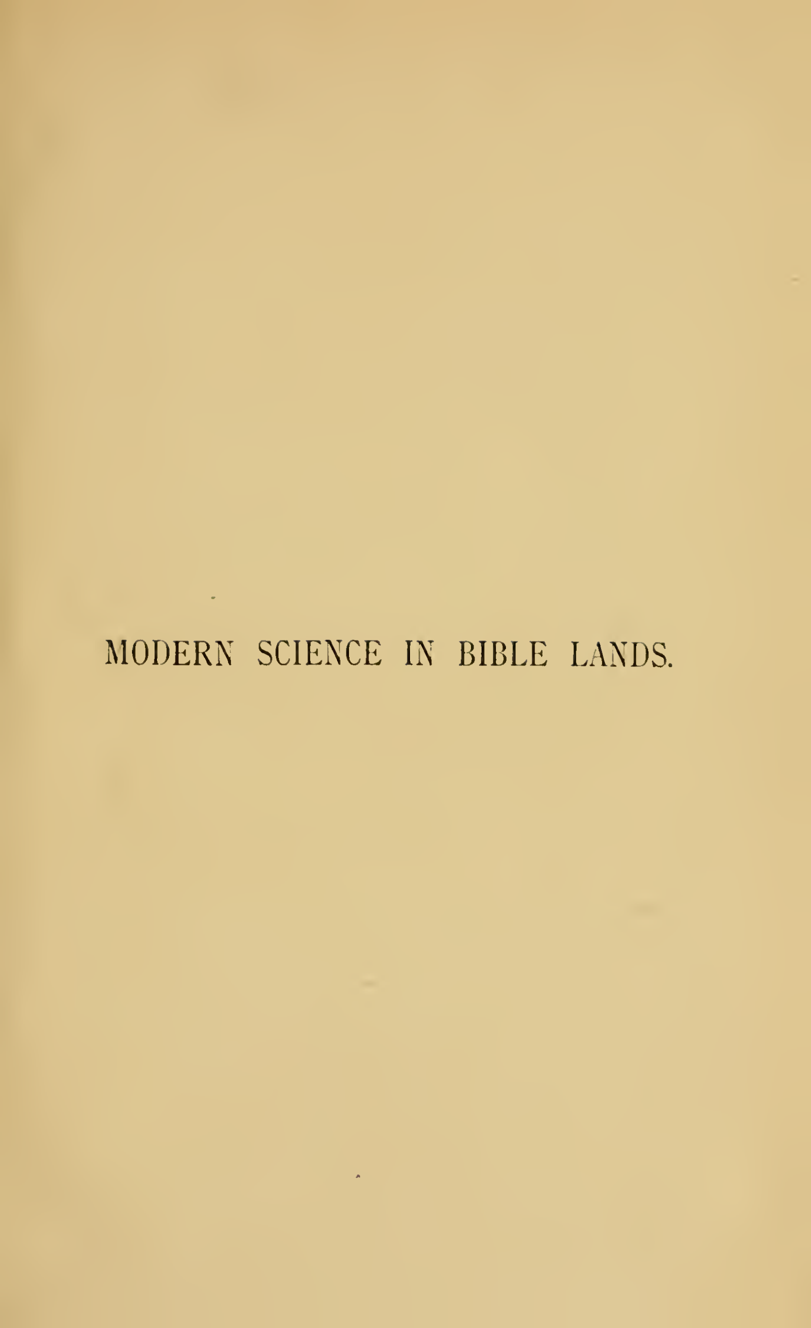


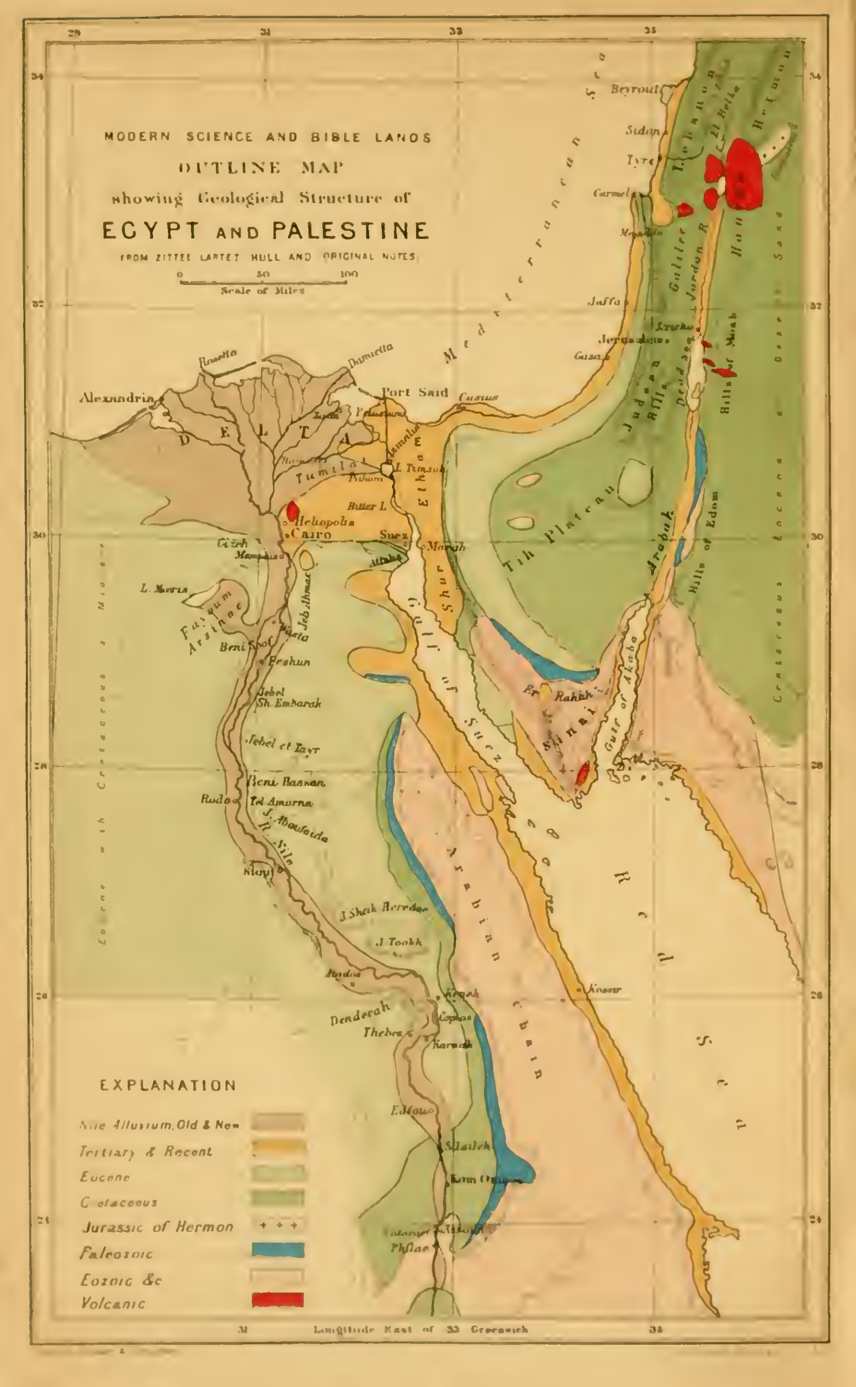






MODERN SCIENCE IN BIBLE LANDS.




MODERN SCIENCE AND BIBLE LANDS
OUTLINE MAP
showing Geological Structure of
EGYPT AND PALESTINE
FROM ZITTEL LARTET HULL AND ORIGINAL NOTES
Scale of Miles
EXPLANATION
Nile Alluvium, Old & New
Tertiary & Recent
Eocene
Cretaceous
Jurassic of Hermon
Paleozoic
Eozoic &c
Volcanic
Longitude East of Greenwich
Mediterranean Sea
Beyrout
Sidon
Tyre
Carmel
Jaffa
Jerusalem
Gaza
Alexandria
Rosetta
Damietta
Port Said
DELTA
Heliopolis
Cairo
Suez
Bitter L.
L. Timsah
Tih Plateau
Sinai
Gulf of Suez
Gulf of Akaba
Arabian Chain
Red Sea
Hills of Edom
Hills of Moab
Dead Sea
Jordan R.
Galilee
Judean Hills
Lebanon
Hermon
Fayoum
L. Moeris
Beni Suef
Beni Hassan
Tel Amarna
R. Nile
Siout
Denderah
Thebes
Karnak
Edfou
Silsileh
Kom Ombo
Philae
Kosseir

MODERN SCIENCE

IN

BIBLE LANDS.

BY

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To

MY DEAR WIFE,

THE COMPANION OF MY JOURNEYING,

AND MY WISE ADVISER AND FAITHFUL HELPER IN EVERY

GOOD WORK, THIS VOLUME IS

AFFECTIONATELY

Dedicated.



PREFACE.

IT is said that a preface is seldom read, but I would earnestly deprecate this in the case of that now before the reader, since I have some explanations to make, as a geologist venturing to discuss the relations of his science to very different departments of study.

The motive of this work is the desire of the author to share with others the pleasure and profit of a tour in Italy, Egypt and Syria, in which it was his special aim to study such points in the geology and physical features of those countries as might throw light on their ancient history, and especially on the history of the sacred Scriptures.

As a geological observer of somewhat wide and varied experience, he hopes that it may be possible for him to elucidate some difficult geological and historical questions, and to present to the reader, whether geological or non-geological, intelligible and it may be novel ideas as to the structure and history of the countries referred to.

It was originally intended that the materials col-

lected should assume the form of notes of travel; but unforeseen delays have made this less desirable, and the several subjects discussed have therefore been arranged under the districts examined, beginning with Italy and ending with Palestine, while under each head subjects relating to geology and to prehistoric and historic human periods have been grouped together as seemed most likely to render them interesting and intelligible, without any personal narrative, except where notes of this kind appeared to be incidentally valuable. It may however be proper to add, that the collections and observations referred to in Egypt and Palestine were made in the winter of 1883–84.

The point of view of the author is that of a geological observer, and his conclusions on matters of that kind may be received as those of an expert. Other departments, whether of science, history, or biblical interpretation and criticism, must occupy a subordinate position, as not being specialities of the writer, and as consequently demanding in many cases dependence on the labours of others, verified however by his own reading and study of monuments and objects of art.

Certain geological facts and discussions, important as evidence of conclusions stated, but not likely to interest the general reader, have been relegated to

an Appendix, which it is hoped may form a useful guide to the geology of Palestine and Egypt.

In the matter of names, the usual spelling has ordinarily been employed, as the recent attempts to give the true phonetic value of Hebrew and Egyptian names in English characters, do not seem sufficiently successful to deserve imitation.

The author has to acknowledge much kindness and valuable information received from many friends. He would especially mention with gratitude in this connection, Sir Evelyn Baring, Col. Ardagh, Sir Colin Scott Moncreiff, Dr. Schweinfurth, Emil Brugsch Bey, Mr. A. H. Hooker, of Cairo, Rev. Dr. Merrill of Jerusalem, Rev. Dr. Bliss, Dr. Post and other Professors of the American College, Beyrout.

The Geological Map is to be understood as giving the broadest possible outline of the structure of the regions to which it relates. It has been kept free from unnecessary detail in order to make the general arrangement of the formations as clear as possible, and to show the geological relations of Palestine and Egypt to each other. It will be found especially useful in illustration of Chapters V. to VIII. inclusive, and of the Geological Appendix. In consequence of an accidental detention of proofs, some errors in the northern part of the map remain

uncorrected. To remedy this, a more detailed map of Northern Syria, on a larger scale, has been introduced into chapter viii., p. 455.

J. W. D.

McGill University,
April, 1888.

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Eozoic.	Earliest Land (Lower Laurentian) Laurentian Huronian	Protozoa	Protogens (in Graphite beds)	Third Creative Day. Land and Vegetation. Fourth Creative Day. Continental Changes & Metamorphism.
Palæozoic.	Cambrian Ordovician Silurian Erian Carboniferous Permian	Invertebrates Fishes Amphibians	Algæ and Protogens Acrogens and Gymnosperms	Fifth Creative Day. Invertebrates and Fishes.
Mesozoic.	Triassic Jurassic Cretaceous	Reptiles and Birds	Cycads and Pines Palms and Angiosperms	Reptiles and Birds.
Kainozoic.	Eocene Miocene Pliocene Pleistocene Palanthropic Neanthropic	Mammals Man and Recent Animals	Angiosperms Existing Vegetation	Sixth Creative Day. Mammals. Antediluvian Man,—Seventh Day. Post-diluvian Man.

CHAPTER I.

INTRODUCTORY.

The present work is not intended to discuss general questions as to the relations of the Bible to science. These I have treated of elsewhere.[1] Its special object is to notice the light which the scientific exploration of the countries of the Bible may throw on the character and statements of the book. More especially it will relate to observations made by the writer as a traveller in Bible lands, supplemented, however, by the work previously or subsequently done by others, and with a somewhat extensive application of the term "Bible lands," more particularly in reference to those older portions of the Bible which are not specially Palestinian.

Very much has undoubtedly been already done in this fruitful field, and a long array of scientific and biblical students might be cited, who have worked in it; but many valuable gleanings still remain, more especially as every explorer discovers some new facts; and I trust that the reader, whether scientific

[1] "Origin of the World," London, third edition, 1886.

or theological, or neither, will find in the following pages much that is at least suggestive.

It will fortunately not be necessary for us to devote much time to disputed questions of biblical literature or criticism, however important in some respects these may be. It need not concern us very much when or by whom the biblical books were written, or what may be the precise character of their claims to inspiration, or the nature of their spiritual teaching. We shall merely take them as we find them, and ask to what extent their statements, as to matters ot natural fact, correspond with what the prying eyes of scientific travellers discover in our time. We cannot, however, altogether escape from the consideration that the antiquity and genuineness of these books, it established, add to their interest, and give importance to their study. We may, therefore, in this chapter, note some preliminary facts and conclusions bearing on these points. We shall also find many incidental corroborations of biblical statements, many explanations of difficulties, many reasons to respect not merely the integrity but also the accuracy and intelligence of the writers of the books of the Old and New Testament. These will, however, be incidental to our work, and will afford such corroboration as may proceed from undesigned coincidences, rather than from attempts at reconciliation.

In connection with this, we may note that one ot the characteristic excellences of the books of the

Bible, which renders their treatment in the manner proposed here very agreeable and interesting, is the eminent truthfulness of the writers in their references to nature, as it existed around them. That this is the case is, I think, the conclusion of all competent students. In this point of view, indeed, the Bible unquestionably stands pre-eminent, even in its poetical portions, over all other literature, ancient and modern. It has no theories to support, except the general doctrine of an Almighty Creator. Its notions are not warped by any superstitions born of myth or idolatry. Nature is to it neither a goddess nor a sport of chance, nor a mere field for the excursions of unbridled fancy, but an ordered cosmos working out the designs of its Maker. Hence a reverence for natural truth, a love of nature, a trust in it and its laws, which one fails to find in other literatures. One can scarcely read a page of any ordinary poem or literary work, ancient or modern, without finding incorrect statements as to natural facts, or false hypothetical views, or quaint, imaginative superstitions. The Bible is notably free from such peculiarities; and, independently of its claims to inspiration, this property gives to it a high degree of estimation in the eyes of a naturalist who is able to follow accurately its statements as to the world in which its writers moved.

This environment of the writers presents local differences in particular books of the Bible. The Book of Genesis, up to the migration of Abraham

into Canaan, is cosmopolitan rather than Palestinian. So far as it has local colouring, this belongs to the Euphratean valley and its surroundings, rather than to any other country; and the Chaldean literature which has survived furnishes the best terms of comparison with it. In the time of Abraham and the early patriarchs it becomes primitive Palestinian, referring to Canaan and its people at a time when both were very different from what they became in subsequent times. With Jacob and Joseph it goes down into Egypt, and the later books of the Pentateuch have a decided flavour of that wonderful country. Exodus is, in its opening, especially an Egyptian book, but it soon takes us out into the Arabian desert, and the aspects of desert life prevail, mixed with Egyptian ideas, till the settlement in Canaan. Henceforth the Old Testament is conversant with the geological structure, the climate, the animals and plants of Palestine. The New Testament opens with a later phase of Palestinian life, and then launches forth into the wider area of the Eastern Mediterranean, from which much of its local colouring is taken.

In treating, then, of the Bible lands, we have to attend to these special characteristics of different books, belonging to different times and places; and we shall find a great variety of questions arising from these, which relate to various regions, from the original home of man and the conditions of antediluvian times and of the deluge, down to the local

relations of the early Christians, and the symbols derived from natural facts by means of which the apocalyptic seer of the first Christian century pictures the final destinies of the world. It will not be possible, however, for us to consider these in any very definite chronological or topographical order; but rather in the arrangement deduced from their general natural connections with one another, adhering, however, as closely as possible to a geographical sequence.

The necessity throughout all this of careful attention to facts, sometimes apparently unimportant, will strike us everywhere, and we shall find the observation of every relevant local circumstance of the utmost value. Examples of the necessity of this from modern literature might be given in profusion. I have on my shelves a library of books on questions relating to the Bible and science, and to historical criticism of the Bible, and it would scarcely be too much to say that hardly one of them is free from gross errors arising from inattention to or ignorance of natural facts which the writers of the Bible well knew and rightly used.

As an illustration which strikes me at the moment, and to which we shall have to return in another connection, I may refer to the recent elaborate, learned and, in the main, wise and thoughtful attempt of Prof. Fried. Delitzsch to fix the site of Eden, where it unquestionably was in the view of the author of Genesis, on the Lower Euphrates; a theory which

has been adopted by Mr. Baden-Powell and other recent writers. The one weak point in this theory is, that while the author knows that in early post-diluvian times the Persian Gulf extended farther north than at present and the Tigris and Euphrates ran separately into the sea, instead of being branches of the same river, as stated by the writer in Genesis, he is ignorant of another geological fact of even greater importance. This is, that in the antediluvian time, the post-glacial continental period of geology, in which man seems to have appeared, the Persian Gulf was smaller than at present. and the united Tigris and Euphrates a longer stream than now. while the surrounding district must have been elevated and wooded, rather than swampy. This fact was evidently known by tradition to the writer of the description of Eden, who fixes its site without reference to the geographical conditions of his own time, but with reference to those which he believed to have prevailed in the time of Adam. This one fact, which has been brought into prominence by modern scientific inquiry, at once removes nearly all the difficulties attending this old description, and as we shall see, throws entirely new light upon the whole subject. In like manner, failure to appreciate the geological changes which have occurred at the Red Sea and in the Isthmus of Suez has long encompassed with difficulty the story of the Exodus. Similar difficulties as to the site of mount Sinai and the physical condition of the surrounding country

have only recently been removed by the labours of the Ordnance Survey, the results of which seem still to be unknown to some learned writers on the subject.

Some remarkable illustrations of the meagre knowledge applied to biblical questions appear in a recent controversy as to the narrative of creation carried on by combatants of no less note than Réville, Gladstone, Huxley, and Drummond.[1] The battle-ground of these combatants was principally that of the introduction of animals, as stated in Genesis i.; and as this is a subject not directly within our present scope, it may all the better afford an illustrative example, introductory to our own special field, in which it may serve to dispose of some preliminary questions.

In the first place, the combatants are not at all clear as to the date or unity of authorship of the documents they are about to discuss, except that several of them are disposed to adopt those views of later German criticism which disintegrate the early Bible books into fragments, most of them of late date and very unskilfully pieced together in order to be palmed off as early documents. It is evident that this idea robs the question of much of its interest. If we regard the Homeric poems as belonging to an age near to that of the siege of Troy, it becomes of great importance to note their hints of manners and of local facts; but if we hold them to be late

[1] *Nineteenth Century*, 1886.

writings by a man or men who, like ourselves, could merely conjecture as to the primitive story, their value will disappear. So the whole importance of the Assyrian tablets or of the older Egyptian papyri depends on our belief in their age. If any one could convince us that they are mere simulated antiques, prepared at a later time, we would turn from them to more profitable and authentic documents. Those who hold such views and yet battle about the meaning of records assumed to be fictitious, are thus self-condemned as triflers.

I have already said that in the discussions of the present volume these questions are of less importance ; but it is nevertheless true that modern science must on its own evidence condemn the ingenious theories of such schools as that of Welshausen and his followers.

The earlier parts of Genesis are undoubtedly intensely archaic in their style and manner, even in comparison with most of the other Hebrew books. They have no references to subsequent facts or events. They are not specially Palestinian and local, but have features in common with the earliest fragments of Chaldean and Egyptian literature. They have no special reference to the institutions of the Hebrew commonwealth, and have a simplicity in their subjects, and the mode of treating them, which speaks of the dawn of civilization. There is nothing in their texture to prevent them from being even more ancient than the time of Moses, and

belonging to a period before the Hebrew race had separated from the main Turanian and Semitic stocks. The probability of this is strengthened by their connection, as to the matter of their statements, with the primitive Chaldean documents recently discovered, and even with the remnants of the creation myths of American races. To a scientific mind these are *prima facie* evidences of their antiquity and genuineness.

These statements apply to the so-called Jahvist as well as to the Elohist portions of Genesis. At one time it was the fashion to regard the Elohist as the elder. Now the tide sets in the other way. But all the documents of antiquity are full of cases where distinctions of this kind are made, as between the Godhead and persons thereof, or as between different aspects of God.[1] It is curious in this connection that, in some instances, as in the history of the Flood, the Jahvist portion is nearer to the ancient Chaldean legend than the Elohist passages, and therefore, if there is any difference, is apparently older, though the name Jahveh is the more especially monotheistic.[2] The attempt to separate these old records into distinct documents of late date, even if it were not greatly discredited by the extreme

[1] Schröder, Chaldean Documents.

[2] The Book of Genesis undoubtedly represents the name Jahveh as in use in antediluvian times (Gen. iv. 1 and iv. 26; and the statement of Réville, that Exodus vi. 2, 3, contradicts this, is altogether superficial and inaccurate, as might easily be shown were there time to state the arguments in the case.

differences of its upholders among themselves, does not commend itself on general grounds to the scientific student. We are familiar in palæontology with animals and plants of very generalized structure; but instead of regarding this as evidence that they are composite creatures artificially put together. we rather consider it as proving their primitive and unspecialized character. The oldest air-breathing vertebrates known to us are certain reptilian or semi-reptilian creatures of the Carboniferous age, to which the name of *Stegocephala* has been given. Now, if I find that one of these animals has a head resembling that of a frog, vertebræ like those of a fish, and scales and limbs resembling those of a lizard, I do not separate these into distinct portions and place them in separate cases of my collection. and invent a hypothesis that they are of different ages. I recognise in the apparently composite and undifferentiated character of the remains, evidence that they belong to a very primitive animal. So. in like manner, the older Palæozoic insects are generalized forms. The same fact applies to the early Mammals of the Mesozoic age and to the Ungulates of the Eocene; and in all these cases we regard this as appropriate to older forms. I believe this is the really scientific view to take of the Pentateuch, except in so far as it is probable that the earlier portions of it consist of old records of the Abramidæ existing anterior to the Exodus. In any case we must regard the early chapters of Genesis

as one homogeneous document, and the evidence as to its age will develop itself in the sequel, when we place it in relation to local peculiarities.

A like infirmity in what may be called "accurate learning," is shown in the innocent ignorance of the fact that the great antiquity of the earth and its preparation for long ages in the interest of man, is an idea as old as the oldest literary monuments of our race, and that in placing this in the definite form of creative days, the Old Testament is not deviating from the uniform tradition of antiquity, or ranging itself by the side of mediæval divines, whom some modern scholars seem to venerate more than they do either ancient literature or modern science.

What if the writer of Genesis intended, and his successors in Hebrew literature understood, that the creative days are days of God, or Divine ages—*Olamim* as they are elsewhere called—or, which amounts to the same thing, that they represent such periods of time. The writer of Genesis i. obviously sees no incongruity in those early days which passed before there were any arrangements for natural days—"dies ineffabiles," as Augustine calls them—nor in the fact that the day in which the Creator rests goes on until now without any termination; nor in the statement that the whole work could be comprehended in one day, "the day when Jahveh-Elohim made the earth and the heavens;" and if this last summary be called later and Jahvistic, it will have the additional value of being the comment of

an editor who may be supposed to have understood the documents he had to do with.

If we are to attribute the decalogue to a later period than the first chapter of Genesis, which the whole tenor and consistency of the history seem to require, the argument is rendered conclusive by the position of the fourth commandment in the midst of the "ten words," and by the reason attached to it, the whole of which would otherwise be inexplicable and even trifling. A later writer, in the Epistle to the Hebrews (chap. iv.), explains this. When God entered into His rest He gave that rest also as an eternal Sabbath to man in Eden. But man fell, and lost the perpetual or olamic sabbatism. There remained to him in the weekly sabbath a memento of the lost rest and an anticipation of its recovery by a Redeemer in the future. Hence the Sabbath was not only the central point of the moral law, but of all religion, the pledge and the commemoration of the Divine promise, and the means of keeping it before men's minds from age to age, till the promised Redeemer should come. It is this that causes the Sabbath to be insisted on as the most essential point of religion by the Hebrew prophets; and this is the reason of its connection with the days of creation. This also caused the necessity of its change by Christians to the Lord's Day without any new enactment, for on this day Christ arose to enter on His sabbatism, "as God did into His." The Lord's Day now has the same significance to Christians, as the

type of the rest into which the Saviour has entered, and which has continued for 1800 years, and of that eternal Sabbath which remains to the people of God. In truth, independently of all considerations of cosmogony, the long seventh day of Creation and the long heavenly rest of the Saviour constitute the only valid reasons either for the Jewish or Christian Sabbath. That Jesus Himself held this view we learn from His answer to the Pharisees who accused Him of breaking the Sabbath. "My Father worketh until now, and I work."[1] That the apostolic Church had the same view of the creative days and the Creator's rest, we learn from the Pauline use of the words *aiōn* and *aiōnios* with reference to God's ages of working, and from the passages in the Epistle to the Hebrews already referred to.[2]

The creative days are the "antiquities of the earth" spoken of in Proverbs viii. They are the *Olamim*, or ages, noticed as equal to God's creative days in Psalm xc., for which even the Revised Version retains the unmeaning "from everlasting to everlasting." This Psalm, too, is a very archaic one, resembling in its diction the songs attributed to Moses in Deuteronomy. Psalm civ. is a poetical version of Genesis i., and in it the work marches on in

[1] John v. 17 (Revised Version).

[2] 1 Cor. ii. 7; Eph. iii. 9; 1 Tim. i. 17; John i. 2, etc.; Heb. i. 2; iv. 4 to 12. In some of these passages the sense is obscured in our version by the use of the term "world," which is an incorrect translation unless understood in the sense of *time-worlds*.

slow and solemn grandeur, without any reference to days. Again, there is not anywhere in the Bible a hint that the work of creation was remarkable as being done in a short time. Some of us have no doubt been taught in childhood that God's power was wonderfully shown by His creating the world in the short space of six days; but there is nothing of this in the Old or New Testament.

Lastly, the idea of long prehuman periods exists in nearly all the traditions of ancient nations, and is contained in the Chaldean record, though it wants the division into days. Yet the Chaldeans had a week of seven days, and regarded the seventh as unlucky with reference to work, and as a day of rest. That this idea of long creative periods has been obscured in our time, is one of the lamentable inheritances of the darkness of the Middle Ages. It is time now to revive it, not only in learned discussions, but in popular teaching. Every school child should know the pre-adamite age of the world, and should understand that the belief of this is necessary to the harmony of the biblical books and the comprehension of the Bible history. Children of larger growth might profitably have their attention directed to the details of the development of the earth as disclosed by science, and pictured beforehand in Genesis, in the manner indicated in the table prefaced to this chapter.

Our modern wranglers over Genesis seem all to be staggered by the bold statement that vegetable life

appeared on the earth a whole period before animals, and even before the final arrangement of the physical details of our earth's relation to the sun. But this is a trite conclusion to natural science. The constitution of the atmosphere and relations of the sun and moon to the earth, were in some respects different from what they are now, long after the beginning of life. Vegetation in some form must have existed before there could be animal life. Vegetation on the land must have existed before there could be air-breathing animals. This necessity may not have been known to the writer of Genesis, but it is well known to us. The most startling point in the old record is, that the primitive vegetation includes not only the humbler cryptogams ("Deshe," not "grass," as in the authorized version), it also contained seed-bearing herbs, and trees bearing fruit.

So far as geological discovery has yet reached into the older layers of the earth's crust, it has found abundant remains of animals as low as the Lower Cambrian; and it has traced land vegetation of arboreal forms, though of very peculiar organization, nearly as far; but below this there is a vast thickness of both crystalline and fragmental rock, in which Eozoon of the Laurentian stands out as the sole representative of animal life; and its claim to be an animal is still in question. But land plants are not known to reach so far back. None are known so old as the Lower Cambrian, so that

marine animals, and probably marine plants, appear to have existed long before land plants. Yet the geologist cannot safely deny the existence of land vegetation even in the old Laurentian period. We know that there was land at that time; and in the middle of the Laurentian series there exist in Canada immense bedded deposits of carbon, in the form of graphite with ores of iron, which cannot be accounted for on any known principles of chemical geology, except by supposing the existence of abundant vegetation. It is true that Eozoon exists in these beds, but it is in any case a mere precursor or foreshadowing of animal life, while the quantity of Laurentian carbon which it would seem must owe its accumulation to the deoxidizing agency of plants, is enormous. Whether we shall ever find Laurentian rocks in a condition to yield up the actual forms and structures of this old vegetation is uncertain; but we know on strictly scientific evidence, as certainly as we can know anything inferentially, that it existed; and we can even by analogy know something of its probable character. Of its precise relations to modern plants we have no information except the record in Genesis. If it was given to the primitive prophet of creation to see in his vision the forms of Laurentian vegetation, he saw what no geologist has yet seen, but what some geologist of the future may possibly see. In any case he has to thank the discoveries of Sir William Logan and his *confrères* in Canada, for establishing

at least a probability on scientific grounds that he was right; and until these discoveries were made, the fact of pre-Cambrian vegetation rested on his sole authority. It may be said that such vegetation would be useless; but the same remark may be made as to the lower animals which existed so long before man, or as to the exuberant vegetation of some oceanic islands untenanted by the higher animals.

The points on which the recent controversies to which I have referred principally turned are, however, those relating to the order of the introduction of animal life, which occupies the two last days of the Mosaic creative week. Here, fortunately, we have ample material for comparison of the two records; and if they do not agree, it is here that their divergence must appear. But to give fair play to the old historian, it will be necessary to examine his method and to weigh well his words.

The method of the writer of Genesis, in describing the work of the fifth and sixth days, is similar to that employed in reference to the previous periods, but in some respects more complex, as befits the higher theme. He states first the Divine purpose or decree under the formula "God said"; next the actual production of the objects intended—"God created"; next the contemplation of the work and its subsequent development—"God saw." Let us put down these stages in order, as given for the fifth day.

(1) "God said, 'Let the waters swarm swarmers having life (animal life), and let fowl[1] fly over the earth on the surface of the expanse of heaven."

(2) "God created great reptiles[2] and every living moving animal with which the waters swarmed after their kind, and every winged animal after its kind."

(3) "God saw that it was good, and God blessed them, saying, 'Be fruitful and multiply and fill the waters of the sea, and let fowl multiply in the earth.'"

This is, I think, a sufficiently literal rendering of the record, as it stands in the Hebrew text, so far as the English tongue suffices to represent its words; but some of these terms require consideration. The word *sheretz*, used for the first group of creatures, literally "swarmers" or swarming animals, is precisely defined in the law respecting animal food in Leviticus xi. There it is used as a comprehensive term, to include all the lower animals of the waters, with the fishes and batrachians, as well as certain animals of the land, viz., the land snails, insects, spiders, and scorpions, along with small reptiles and perhaps, though this last is not quite certain, some small quadrupeds usually regarded as vermin. The precise definition given in the law respecting unclean animals leaves no doubt as to the meaning of the word. We thus learn that the creation of the fifth day included all the marine invertebrates, and the

[1] Used in the old sense of "flying animal."

[2] *Tanninim*, that is, crocodiles.

fishes and batrachians, with the insects and their allies, or at least all such as could be held to be produced from the waters. The link of connection which binds all these creatures under this comprehensive word is their teeming oviparous reproduction, which entitles them to be called swarming animals, in connection with their habitat or origin in the waters, and no term could better express that inswarming of lower forms of marine life which meets us in the Cambrian age of geology. Thus this one word covers all the animals known in the Palæozoic and Mesozoic periods of geology, with three notable exceptions—the birds, the true reptiles, and the marsupial mammals. But singularly, and as if to complete his record, this old narrator adds two of these groups, as though they had specially attracted his attention. The word *Oph*, fowl, bird, or winged animal, is the usual word for birds in general, though in Leviticus it includes the winged insects and the bats, which are winged mammals. As it is a very primitive and widely diffused word, and probably onomatopoetic and derived from the sound of wings, it may in early times have served to denote all things that fly, though applied to birds chiefly. The second group specially singled out is designated by the word *Tannin*, which, like *oph*, is a very old and generally diffused word,[1] denoting primitively any animal long and extended. In the Hebrew Bible it is, however, used in almost every place

[1] Sansc., *Tan;* Greek, *Teino;* Latin, *Tendo*, etc.

where it occurs, either for the crocodile [1] or for the larger serpents. In Exod. vii. 9, the next place where it appears, it represents the great serpent produced from the rod of Moses. There is no warrant for the rendering "great whales," borrowed from the Septuagint, and still less for the "great sea monsters" of the Revised Version.[2] If we ask what animals the writer can have meant by *tanninim* the answer must be, either crocodiles or large serpents or creatures resembling them. Thus our author does not overlook altogether the "age of reptiles," though he does altogether omit the "whales," a lapsus to which we must revert immediately. There are, however, known to us in the Mesozoic period a few small insectivorous and marsupial mammals, humble and insignificant precursors of the age of mammalia. These our author has apparently overlooked; but he has an excuse for this in the fact that most of these creatures do not occur in modern times, except in Australia or America; and even if known to him, he may have had no special word by which they could be desig-

[1] See, for example, Ezek. xxix. 3 and xxxii. 2. Jeremiah compares the king of Babylon to a *Tannin*, and may refer to a Euphratean crocodile, now apparently extinct (Jer. li. 34).

[2] The word is usually rendered in the Sept. *Drakōn*; but another word, *Tan*, a name apparently of the jackal, has been confounded with it in that version. When the later Hebrew writers had occasion to refer to the whales, they used the word Leviathan, though in earlier writers this also is applied to the crocodile. Compare Ps. civ. 26 and Job xli.

nated, or their appearance may have been too insignificant to attract his attention.

Even with the above deduction, it must be confessed that this history of the fifth creative day presents a marvellous approximation to the two earlier periods of animal life as known to geologists —the age of invertebrates and fishes, and the age of reptiles.

It is a curious point, that just as modern systematists have been disposed to insist on the affinities of the batrachians with the fishes, and of the birds with the true reptiles, this ancient writer, if he had the batrachians before his mind, includes them with the fishes, and singles out the birds and higher reptiles as companion groups, at the summit of the animal kingdom in their day. It may be somewhat unfair to test so popular and general a statement by such details; but if an author who lived so long before the dawn of modern science is to be tested at all by our present systems, it is proper at least to give him the benefit of the consummate skill which he shows in avoiding all inaccuracy in the few bold touches with which he sketches the introduction of animal life.

The argument in favour of the scientific precision of the writer of Genesis, as compared with the inaccuracies of his modern commentators, might perhaps be closed here, without fear as to the verdict of reasonable men. But there is a positive side as well as a negative to this vindication, and we must not

rest content with a bare verdict of "Not guilty," lest we should fall into the condemnation of being mere "reconcilers." Our ancient author has something to say respecting that formidable word evolution so constantly ringing in our ears, and which while some regard it as opposed to Genesis, is by others believed to be consistent with revelation, or at the least with the argument of design. With reference to the origin and becoming of things, legitimate science is conversant with two ideas, that of causation and that of development. Causation may either be primary as proceeding from a creative will, or secondary as referring to natural law and energies. Development may be direct, as in that of a chick from an egg, or indirect, as in the production of varieties of animals by human agency. Now it so happens that by the school of Spencer and Darwin the word evolution is used as covering all these kinds of causation and development; and by what Mr. Gladstone calls a "fallacy of substitution," or what I have elsewhere termed a scientific sleight-of-hand or jugglery, we are carried from one to the other almost without perceiving it, until we can scarcely distinguish between a causal evolution, which is a mere figure of speech, and a modal evolution, which may be an actual process going on under ascertained laws and known forces. So difficult has the discrimination of these things become, that it is a serious question whether sober men of science should not discard altogether the term evolution,

and insist on the use of causation and development each in its proper place, a course which I propose to follow in the subsequent chapters.

These questions were living issues in the time when Genesis was written. It was then a grave question, not at all decided in the minds of the most learned priests of Chaldea and Egypt, whether one God had made all things, or whether they had arisen spontaneously, or were the work of a conflicting pantheon of deities. How does our ancient authority stand in relation to this great question? He recognises causation in the one creative will—"God said," "God created"; and thereby affirms a first cause and the unity of nature. Secondary causes he also notices in the agency of the waters, the atmosphere, and the land, and in the law of continuity implied in the words "after their species." Development he sees in one form in the progress of the creative plan, in another in the power of fruitfulness and multiplication. Yet these several ideas are distinctly and clearly defined in his mind, and are so expressed, even in the brief statements which he makes, that each is kept in its proper place relatively to the end which he has in view. It is not too much to say, that any plain man reading and pondering the history of the development of the creative plan in Genesis may obtain clearer and more correct views as to the origin and history of animal life, than it would be possible to reach by any amount of study of our modern popular

evolutionary philosophy. How did this ancient writer escape the mental confusion which clouds the minds of so many clever men in our time? It may be said it was because he knew less of scientific detail; but possibly he had a higher source of enlightenment.

It is also interesting to note the strangely unerring instinct with which he seizes the relative importance of different kinds of creative work. He had selected the word *Bara*, "create,"[1] to express the most absolute and original kind of making in the production of the materials of the heavens and the earth. He is content with the less emphatic *Asa*, "made," when he speaks of the expanse, the great lights, and even the later animals. But he signalizes the first appearance of animal life by a repetition of "create," as if to affirm the great gulf which we know separates the animal from dead matter. In like manner he repeats this great word when he has to deal with the new fact of the rational and moral nature of man. Should man ever be able to produce a new living animal from dead matter, or should the spontaneous development of the higher nature of man from the instinct of the brute become a proved fact of science, we may doubt his wisdom in the selection of terms, but not till then.

[1] This statement is sufficient to vindicate the translation "create," for *Bara;* but it could be confirmed, if necessary, by citing every passage in which the word occurs in the Hebrew books, whether in literal or figurative applications.

Observe also how, without in the least derogating from this idea of creation, in the words, "God said, Let the waters swarm swarming animals, after their kinds," he combines the primary Almighty fiat with the prepared environment and its material and laws, the reproductive power and the unity and diversity of type. Here again he proves himself not only a terse writer but an accurate, and, may we not add, scientific thinker.

I have little space for the consideration of the Sixth creative day; but what has been already said will render less comment necessary. Here the statement is longer, as befits the introduction of man; and the day is divided into two separate portions, in each of which occurs the threefold fiat, act, and development. It is interesting in this connection to note, that while man is introduced in the same creative day with the higher animals nearest to him in structure, his greater importance is recognised by giving him a distinct half-day to himself.

The land is here commanded to bring forth its special animals, but these are no longer *sherātzim*, birds and reptiles, but the mammalian quadrupeds. The three terms used to denote these creatures are translated, even in the Revised Version, by the notably incorrect words—"cattle, creeping things, and beasts of the earth." It requires no special scholarship, but only the industry to use a Hebrew concordance, to discover the simple and familiar use of these words in the Old Testament. *Behemah*,

though including "cattle," is a general name for all the larger herbivorous quadrupeds; and in Job the hippopotamus is characterized as the chief of the group. These animals appropriately take the lead, as culminating first in the age of mammals, which is also the geological fact. *Remes*, "creeping things," is applied in a very indiscriminate way to all small quadrupeds, whether mammalian or reptilian, and may here be taken to represent the smaller quadrupeds of the land. The compound word *Haytho-eretz*, "beast of the land," though very general in sense, is employed everywhere to designate what we would call "wild beasts," and especially the larger carnivora. This first half of the sixth day is therefore occupied in the introduction of the mammalia of the land. This completes the animal population of the world with the exception of the whales and their allies, which strangely are not included in the narrative. Perhaps it was this apparent omission that induced the Septuagint translators to insert these marine mammals, instead of the crocodile, as the representative of the *tanninim*.[2] The omission has, however, a curious significance, in connection with the proba-

[2] There is a passage in the Authorized Version of the Bible which seems to give countenance to the mammalian idea of this word: "Even the sea-monsters draw out the breast" (Lam. iv. 3). But the correct reading here is understood to be not *tannin*, but *tanim*, "jackals," instead of "sea-monsters," and the word is so rendered in the Revised Version.

bility that this creation document originated before the removal of men from their primitive abodes in interior Asia, and when the whales, as well as the marsupial mammals already referred to, must have been unknown to them. We shall see in a later chapter that the writer of the early chapters of Genesis fixes his local stand-point on the Euphrates; and to a writer so placed, and to his audience, any mention of oceanic monsters like the whales might have been unintelligible. That the Septuagint translators, living on the borders of the Mediterranean, should regard the omission of whales as a defect in the record, was most natural; but if the original narrator and his audience were inland people, dwelling perhaps in the plain of Shinar, they may have been ignorant of whales or of any name for such creatures; and it is in such a case as this that we may legitimately apply the doctrine that the Bible was not intended to teach science. It is just possible, also, that to the Septuagint translators the special mention of the "great tanninim" may have appeared to give too much countenance to the idolatrous worship of the crocodile in Egypt.

It is remarkable that the animals of the sixth day are said to have been "made," not created, as if, after the first peopling of the world with lower creatures, the introduction of the higher forms of life was an easier process. The modern evolutionist may take this much of comfort from our ancient authority.

The second half of the work of the sixth day,

though the more important, may be dismissed here, as it will engage our attention in connection with its local features, insomuch as a locality in the biblical world is assigned to the introduction of man, while that of the lower animals is world-wide. Its distinctive features may be shortly stated as follows. Man was "created," and this in the image and likeness of God, and with godlike power in subduing the earth and in ruling its animal inhabitants, among which, however, in accordance with an intimation in the special record of man in the second chapter, the "wild beasts" are not included. Thus the rational and moral elevation of man on a plane higher than that of the animal kingdom is recognised, and he is made the vicegerent of God on the earth. A certain limitation as to food is also imposed upon him. He is not to be carnivorous, but to subsist on the better and more nutritious kinds of vegetable food—seeds and fruits; and in this we have not only a physiological relation, but also one to climate and locality, as we have also in the irrigation of the "Garden of Eden." These intimations all point to a direct relation of man to his Maker and to a supremacy over the lower creatures, conditions which are more fully specified, in perfect harmony with the earlier statements, in the more detailed account of man and his relations to God and external nature in the sequel of the book (chaps. ii., etc.).

It may be well here to notice the essential differ-

ences between the Hebrew and the Chaldean Genesis, or the fragments of the latter which remain. This is the more important, that both histories obviously point to the land of Shinar and the Lower Euphrates as the cradle of humanity. Unfortunately we have only as yet a passage in which "the gods in their assembly created" living creatures, and these living creatures are specified as "animals of the field, great beasts of the field, and creeping things." So far as this goes, it would seem to indicate a classification of animals like that in Genesis, but a polytheistic belief as to their creation. This polytheistic element is indeed the distinctive feature of the Chaldean record, and raises questions as to the relative ages and religious tendencies of the documents. With respect to the former, it seems certain that the originals of the Nineveh tablets may have been very ancient. They are, however, so mixed up with the history of a Chaldean hero, known as Isdubar, as to give reason for the supposition that there may have been still older creation legends. Again, is it true, as many seem to suppose, that polytheism is older than monotheism? Is it not likely that the simpler belief is older than the more complex; that which required no priests, ritual, or temple, older than that with which all these things were necessarily associated? Further, there is no example of any polytheistic people, spontaneously and without some impulse from abroad, laying aside its many gods. On the contrary, the

Jewish history shows us how easy it is to lapse into polytheism; and we have seen how, in comparatively modern times, the simplicity of primitive Christianity has grown into a complex pantheon of saints. These considerations would entitle the Hebrew record to the earliest place among all the religious traditions of our race, and render still more remarkable its clear, consistent, and natural statements.

With respect to the tendencies of the two documents, it is certain that the Hebrew Genesis is in every way to be preferred. It avoids all the superstitions certain to result from breaking up the unity of nature and deifying its powers, and cuts away the roots of every form of debasing nature-worship. In its doctrine of creative unity and of developed plan, it lays a secure basis for science, while it leaves the way open for all legitimate study of nature. These are great merits, which science should ever be ready to acknowledge. It is in this grand general tendency of the biblical record that the real relations of revelation and science are to be found; and if it is necessary to enter more into detail, this is not for the sake of a so-called "reconcilation," which must necessarily be incomplete, though, on the supposition of a real revelation and a true science, ever improving in exactness; but merely because imperfect views of revelation and of nature have been raising up apparent contradictions which do not exist, and which may tend alike to the injury of science and religion.

One other misconception it may be well to clear away in this introductory chapter. It is that which is expressed in the statement that the narrative of the creation in Genesis i. (Elohist) contradicts that in Genesis ii. (Jahvist), because the first represents man as the latest work of creation, whereas the second speaks of him as made before or along with other animals. There could not be a more glaring instance of misrepresentation, arising from the ignorance of interpreters, though perhaps it may be somewhat difficult to make this plain to unscientific readers. The narrative in the first chapter of Genesis refers to the whole work of creation, from the beginning up to the introduction of man, and is world-wide in its theatre of action. That in Genesis second refers to a special local group of animals contemporary with man in a special locality, that of Eden. In the first, man is the terminal work of the great chain of life extending over the whole world, and throughout all geological time. In the second, he comes into being along with certain other creatures made like himself on the final creative day. The difference is the same with that between the general table of formations in a geological text-book and the special account of the post-glacial or modern period which may follow it. In the one, the human period closes the long series. In the other, man appears as contemporary with species introduced along with him in the later Tertiary period. A superficial reader might see a contradic-

tion in this. He might say, in the one place the writer represents man as succeeding in time all the lower animals. In the other I find him contemporary with animals of every grade. A little reflection would, however, show that the apparent contradiction is really what must be the accurate expression of the fact.

In connection with this, a minute point of agreement between the two statements has been made by carelessness or ignorance into an occasion for conjecturing an omission. In Genesis i. 26 it is said that man is to have dominion over "the fishes of the sea, the fowl of the air, the cattle (herbivorous mammals), and over all the earth." It has been conjectured that here "wild beasts of the earth" (*Hayath-eretz*) should be substituted for the word "earth." But the writer having in view the fact stated later, that man in Eden was placed with a peculiar and select group of animals, probably limits these words intentionally, and implies that man's dominion at first did not extend over the larger carnivora, with which it may be inferred that in Eden he had no acquaintance. Thus an ignorant misconception leads to a gratuitous correction.

Similar considerations apply to the whole of the Edenic narrative introduced in chapter second, which refers, not to the general creation, but to the condition of the earth in that late Tertiary period in which man entered on its possession. We know that im-

mediately before the appearance of post-glacial man there had been a great submergence of the land in the northern hemisphere, and that this was of sufficient duration to destroy all vegetation from the lower and more northern parts of the continents. From this submergence the land rose, destitute of vegetation, and probably, for a time, involved in mists and fogs belonging to the continued precipitation of a pluvial period. This is the condition of things referred to in Genesis ii. 5, and which was destined to give place to the new creation of Eden. I shall show in the sequel that the region intended by the sacred writer as the site of Eden is in the plain of the Lower Euphrates. This district must have risen from the pleistocene sea a vast expanse of barren mud, and centuries must have elapsed before it began to assume the aspect of the Garden of the Lord. Thus a local colouring appears in Genesis ii. which is absent in chapter i., and which, instead of being contradictory, completes the earlier statements.

I am not concerned here as to any cavils that may arise respecting the improbability of an early writer knowing all this, or respecting the different documents supposed to have been pieced together by the editor of Genesis. It is abundantly clear that the writer or writers intended to give first a general account of the creation of the world and things therein, and then a local account of the special circumstances attending the introduction of man.

If both narratives were written by the same writer, at the same time, we see that he must have been well informed, and that he clearly puts what he intended. If the two narratives were originally different documents, or parts of different histories, one relating to creation in general, the other to the special history of man, the editor who put them together must have fully appreciated their bearing, and adjusted them together in a very skilful manner, so as to combine both objects without any contradiction, though his work has been somewhat marred, in our English translation, by some mistranslations and by an unskilful division into chapters.[1]

What I wish principally to impress on the mind of the reader in these preliminary remarks is, that we must not be misled by the authority of verbal critics, however learned and honest, but must be prepared to place the writings of the Bible in the clear light of the local circumstances and natural facts with which their authors were familiar, if we would rightly appreciate their true force and meaning.

While these pages were being prepared for the press, another illustration of the modern errors to which they refer is afforded by some references in the able address delivered by Prof. Sayce, as President of the Anthropological Section of the British Association in Manchester. The question more immediately referred to was, the origin of the Aryan or Indo-

[1] The second narrative begins at Chap. ii. 4.

European languages, which Schrader, Penka, and others have argued must have been in the north-west of the old continent. Among local arguments to sustain this doctrine, it is said that the name of the birch tree is identical in Sanscrit and Teutonic, and as this tree does not exist east of the Crimea, the European language must have had precedence of the Asiatic. Those who use this argument seem to be entirely unaware that there is an Indian birch (*Betula bhajapaltra*), which has furnished from time immemorial a bark used as a substitute for paper, so that the Indian people not only knew the tree, but had an opportunity, as in Europe and America, to connect its name with that of bark, as affording the most useful material of that kind. These philologists also refer to the rash dictum of Mortillet,[1] that the absence of a mental tubercle in some prehistoric jaws implies inability to speak, as though it were a proved result of physiological science; and they attribute an enormous and impossible antiquity to certain neocosmic languages, mixing up facts relating to palæocosmic and neocosmic men without any regard to the geological distinctness of these races. We shall have to recur to some of these points in the sequel; but may remark here that if such oversights could be found in the Book of Genesis, they would be fatal to its claims to historical value.

I am reminded by the words of a somewhat

[1] Discussed in Chapter IV.

remarkable sermon recently preached in London,[1] that our age has produced a class of men unknown in early times, to whom nature is only a dead and causeless machine. Nature, we are told, "cares for neither good nor bad. It binds us with bonds which oppress and crush us. This tremendous side of nature is an idea which enlarging knowledge has brought home to our generation with a sharpness and definiteness never recognised before. It fills and occupies our minds till even the consciousness of will becomes overshadowed and cast into the background. And with this dread image before men's minds there grows up a terrible religion of despair." Or, to put the same idea in the words of a modern poetess:[2]

> "Weird Nature! can it be that joy is fled,
> And bald unmeaning lurks beneath thy smile;
> That beauty haunts the dust but to beguile,
> And that with order, Love and Hope are dead?
> Pitiless Force, all moving, all unmoved,
> Dread mother of unfathered worlds, assuage
> Thy wrath on us,—be this wild life reproved
> And trampled into nothing in thy rage.
> Vain prayer, although the last of human kind,
> Force is not wrath, but only deaf and blind."

All I have to say as to ideas of this kind is, that if they exist to any extent, they are not results of enlarging knowledge but of contracting thought;

[1] St. Paul's Cathedral, May, 1887, by the Very Rev. Dean Church.

[2] Emily Pfeifer.

and that, so far as science is concerned, if they were to become general, they would extinguish its life as certainly as they would extinguish faith in revelation. If the doctrines of destructive historical critics tend to render biblical exposition mere trifling, those of materialists tend to render science not worth following, and therefore, *a fortiori*, any discussion of the scientific features of Bible lands only loss and waste.

Fortunately, however, such materialism is not science, nor a legitimate outcome of science. Any rational and successful pursuit of science implies the feeling of a community between the Author and Contriver and Ruler of nature and the mind which can understand it. To science, nature must be a kosmos, not a fortuitous chaos; and everything in the history and arrangements of the universe must be a manifestation, not only of order, but of design. To it, therefore, the relations now and in time past of man and his surroundings must be matters of lively interest and of invaluable teaching, and their study must tend to the production of that sturdy form of piety which assumes as its first principle the great initiatory truth—"In the beginning God created the heaven and the earth." The true man of science must believe in a Divine Creative will, in a God who manifests Himself, and is therefore not the hypothetical god of the agnostic; in a God who must be distinct from and above material things, and therefore not the shadowy god of the pantheist,

who is everywhere and yet nowhere; in a God who causes the unity and uniformity of nature, and therefore not one of the many gods of polytheism; in a God who acts on His rational creatures daily in a thousand ways by His fatherly regard for their welfare, and who reveals Himself to them—a God, in short, who made the world and all things therein, and who made man in His own image and likeness.





Eruption of Mount Vesuvius, April, 1872.
(From a Photograph.)

CHAPTER II.

THE FIRE-BELT OF SOUTHERN EUROPE.

The basin of the Mediterranean, though so familar historically, and the cradle of the oldest European nations, is in a physical point of view one of the most singular and exceptional features of the surface of the earth. Running nearly east and west, it constitutes a depression with corresponding elevations transverse to the dominant structures of our continents. To the north it is bounded by the intensely crumpled and folded tracts of hard crystalline rocks constituting the Alps and other mountain ranges of Southern Europe. In connection with these there are transverse folds, but really in the normal lines of the continents, forming the nuclei of Greece, Italy, Sardinia, Corsica, and Spain, while the great transverse ridge of Syria, reaching from north to south, closes the end of the basin on the east. Along the southern frontage of the whole runs one of those great fractures of the earth's crust which give vent to its hidden fires; and while the mountains on the north descend abruptly into this

great fracture, the southern side of the sea slopes gently downward from the flat plains and table-lands of northern Africa. These arrangements are geologically of recent date, at least in their final completion. While the central Alpine ridges consist of very old rocks, that must have been folded and upheaved at an early period, and while there is evidence of a Mediterranean of different form from the present, far back in geological time, beds which must in Eocene and Miocene times have been in the bottom of the sea now rise to great heights in the mountains. On the other hand, there is evidence that even so late as the appearance of man in these regions, the Mediterranean was smaller than at present, and divided into two seas, and that it has since undergone important movements of submergence; while all through the later geological ages eruptions of molten matter and seismic disturbance have been going on everywhere along the great line of Mediterranean uplift and depression, and have extended themselves as far as the Himalayas on the one side and across the Atlantic to the Gulf of Mexico on the other.

At the present day the volcanic and seismic belt of Southern Europe can be traced into connection, on the one hand, with the similar region of earthquake and igneous action extending eastward to the Bay of Bengal, and thence till it crosses in Java the great north and south volcanic belt of Eastern Asia, and running through the Pacific Archipelago,

perhaps unites itself with the long Cordillera belt of Western America. Traced westward by the Azores, it may join the volcanic region of the West Indies, and thus become confluent on the other side with the American volcanoes. The volcanic belt of Southern Europe is thus part of a great band which seems to girdle the earth; but in no part of its extent has it shown greater earth movements and ejections, or so closely connected itself with man and his interests, as in the Mediterranean region.

It is a remarkable fact, and not without historical significance, that the earlier migrations of primitive man must have been along this belt of disturbance, and that his westward march along the Mediterranean was lighted by the beacons of volcanic fire, and disturbed by the throes of the unquiet earth.

When palæocosmic or antediluvian man first looked on the Mediterranean, its boundaries were very different from those at present. We are indebted to Professor Boyd Dawkins for a conjectural restoration of the Mediterranean of that time. It was divided into two basins by an isthmus connecting Southern Italy with Africa, or, if not altogether divided, there was only a very narrow connecting strait (Fig. 1). The Adriatic and the Ægean were dry land, Crete and Cyprus were connected by broad plains with the continent. At the same time the upper parts of the Persian Gulf[1] and the Red Sea

[1] The significance of this in relation to recent discussions as to the site of Eden we shall see in the sequel.

were dry land, and there was a broad connection between Asia and Africa, including a great lake or inland basin, into which the waters of the Nile were poured, so that the outlet of the Nile approached to that of the Jordan. The volcanoes of the Greek Islands were then probably active. So was Ætna; and though Vesuvius was not, earlier volcanoes of South Italy, and those of Central Italy now extinct,



Fig. 1.—The Mediterranean in the second continental or Palanthropic Period, when it constituted two detached basins with wide margins of low land.

were probably in action. The plains along the northern and eastern sides of the Mediterranean, wide and sparsely wooded, were tenanted by herds of the mammoth and of the tichorhine rhinoceros. Along these plains, now submerged, early man may have made his way from the East; and while his more civilized communities may have settled in the plains permanently, more active and rude tribes

penetrated inland till he occupied the limestone caves of France and Belgium. We shall have to discuss these primitive men more fully in the sequel. In the meantime we notice them merely in preparation for what is to follow.

When, after that great physical catastrophe which we know as the deluge, or the post-glacial flood, men returned to the Mediterranean basin, it must have presented much the same appearance as at present. If at that time the tradition of the antediluvian world survived among the new colonists, they must have mourned the loss of the great alluvial plains that still remained under the waters, and must have thought with awe of the teeming multitudes of the antediluvian nations whom those waters had overwhelmed, while, unless they carried with them the Divine promise made to Noah,[1] they may have advanced in fear lest a new deluge should overwhelm them.

It is also far from unlikely that movements of depression and elevation, connected with this catastrophe, had intensified for the time the volcanic phenomena of the region. We can well understand the impression produced by these facts on the first tribes that pushed their way into this region, perhaps Turanian or Accadian peoples, far in advance of the later Phœnician and Hellenic communities,—ancestors probably of the Pelasgian, Etruscan, and

[1] Gen. ix. 11. A very important assurance, to give confidence to the early movements of man.

Iberian nations, which seem to have preceded the Aryan races in the occupation of the Isles of the Gentiles. We can well understand how different would be the position of the neocosmic men from that of their antediluvian ancestors with reference to the diminished extent of the land, the want of its great fringing plains, the disappearance of its gigantic fauna. We can also appreciate the new stimulus to maritime enterprise given by the now broken and rugged character of the coast and its multitude of islands.

We can further, understand, that if these early colonists brought with them that animistic religion which we find evidence of in the early Accadian records of Chaldea, while they would recognise in the physical changes which had occurred, the vengeance of the great spirit Hea, or rather of the trinity, Anu, Hea, and Bel, which together constituted their Elohim, they would also see in the volcanic fires and shaking earth the visible evidence of those powers of the abyss, the *Gê* or underworld, who were believed to be in antagonism to God, and groaning and trembling in their agony below the inhabited earth. It would be unprofitable to enter into details as to these obscure and disputed theologies of the old world; but the relation above sketched between them and the Mediterranean fire-belt, under its new post-diluvian aspect, is, I think, unquestionable.

While such influences may be traced everywhere in the Northern Mediterranean from Asia Minor to

Iberia, the most obvious illustrations may be found in Italy, a country so well known historically and geologically. Italy was indeed the pioneer in modern geology; and the study of its formations, by early native inquirers, and afterwards by Lyell and others, first threw light on the succession of the more modern formations of Europe, and on the physical changes to which the Mediterranean area had been subjected.

Italy has a nucleus of old rocks, perhaps as old as the Eozoic age; and against these mantles a series of deposits reaching upward on the flanks of the Apennines to various heights, and certifying to the successive depressions and elevations of the peninsula throughout the Tertiary period and up to historic times. The aqueous deposits and movements, as well as the volcanic phenomena, seem to be oldest in the north and newest in the south. The volcanoes of Northern Italy, as well as those of Germany and France, are probably long since extinct, some of them perhaps even before the beginning of the human period. Those of Central Italy are now extinct, though some of them must have been active within the time of human history. Those of Southern Italy and Sicily still maintain their vitality, and are and have been important factors in the daily life of the people.

The old Etruscans, the fathers and founders of Italian and European civilization, and the disseminators throughout Europe of the bronze which replaced

the stone of the Neolithic age; and whose short. broad heads are those of the noblest and most influential families of ancient Rome, apparently avoided the seats of modern igneous action, and built their towns on the solid crags of the older aqueous rocks, as at Fiesoli and elsewhere in Tuscany, or on volcanoes extinct long before the dawn of history. Still, they were in time to witness some of the volcanic outbursts of Central Italy, for I saw in the Lateran Museum at Rome, sculptured stones, one of them bearing that antique symbol, the cross with bent arms, which had been taken from beds under lava streams at Albano and Marino.

The Etruscans are now justly regarded as the southern and more civilized branch of the Turanian population which, before the Greek and Celtic and Germanic races had invaded Europe, occupied its whole area between the Mediterranean and the Baltic, and westward to the Atlantic. The recent re-discovery of the tin mines of Tuscany has solved the problem of the bronze age in Europe,[1] and has shown that it belongs to the period of Etrusco-Iberian supremacy, before the rise of Rome and the inroads of the Celts. The obligations of Rome to Etruria are now very well recognised. Its early religion, arts, science, and brains came mainly from this source, just as those of the early nations of Asia came from the old Turanian Accadians of the Euphrates, the Cushites of the Bible. In the

[1] Dawkins, "Pre-historic Man in Europe."

museums of Italy we look with wonder on the remains of an early Etruscan art, not Greek, nor Assyrian, nor Phœnician, nor Egyptian, but combining parts of all, and which shows the existence of an old and advanced civilization in Italy, long before the rise of the Greek colonies or of the Roman power.

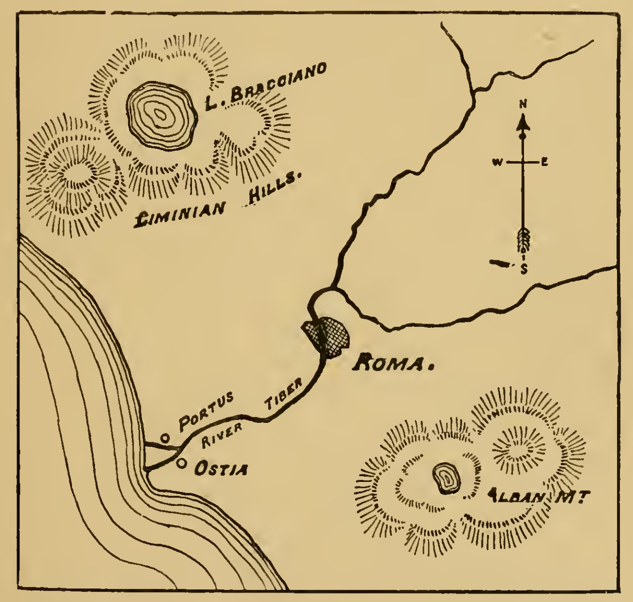


FIG. 2.—Map showing the Position of Rome between two Volcanic Centres.

Rome itself, destined so long to be the mistress of the world, took her place on the marginal débris of two old volcanoes, that of the Ciminian Hills with the old crater of Lake Bracciano on the north, and that of the Alban Hills on the south (Fig. 2). The

débris thrown down from these volcanoes meets on the plain of Tiber; and on this Rome was built. To a geologist, the first question as to any ancient site is—"What were its original condition and the causes of it?" and these facts I have endeavoured to represent in the rough sketch-map (Fig. 3). The Jani-

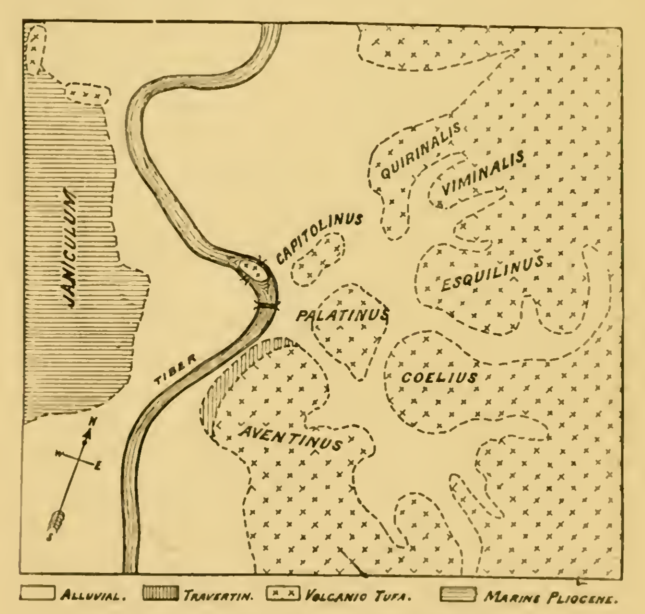


FIG. 3.—Sketch Map of Site of Rome.

culan hill west of the Tiber, which is the oldest part of the site of Rome, is composed of beds of marl, clay, sand, and conglomerate, not volcanic, but holding marine shells, and belonging to a time when that part of Italy was in the bed of the Mediter-

ranean. The rising-grounds on the eastern side of the river, the seven hills of Rome, are composed of volcanic ashes spread out upon, and filling up the pliocene sea. They are now partly consolidated into a volcanic sandstone or tufa, hard enough to be used as a building stone, but sufficiently soft to be readily excavated into the galleries of the Catacombs. They once formed a continuous surface, reaching quite across the valley, but have been cut by the streams and the action of the sea in later submergences, into their present irregular forms. On the flanks of these hills, and especially of the Aventine, are still later beds of fresh-water travertin or recent limestone, a river deposit, showing that in early historic times the Tiber reached to a greater height than at present, to the extent, perhaps, of 130 or 140 feet. These belong to the post-glacial or earliest human period, when the mammoth was one of the wild animals of Italy.

The muddy Tiber, an unmanageable and ill-conditioned river, liable to sudden floods, and leaving when it recedes ugly banks of sand and shingle, had originally cut its way, at the site of Rome, along the junction of the tufa beds on the east with the Janiculan marine beds on the west, and in doing so had made a broad bend, so as to run nearly north and south, or at right angles to its usual course westward to the sea. Where the city was afterwards built there remained in the middle of the river a little island of volcanic sandstone, affording facilities

for a bridge to connect the territories of the Etruscans with those of the Sabines and Latins, and other tribes of the south of Italy; and which must have been, from the first colonization of the country, an important crossing place. But on the south-east side, near the end of the bridge, were two little rugged knolls, the Palatine and Capitoline hills, well suited in unsettled times to form the nests of bandits who might rob unprotected travellers, or, under better government, to furnish sites for forts to protect or defend the passage. The seven hills of Rome are these two isolated eminences, and five spurs of the table-land on the south, which run out toward them. The intervening low ground was originally marshy, and liable to to be inundated by the river. At present much of it is raised by accumulated rubbish to a height of thirty or forty feet above its original level. It was on the tufa knoll of the Palatine that the original square fort of Romulus was built. The Capitoline became a second citadel and a holy place and the intervening flat was drained to form a Forum, or market and meeting place of the tribes. The other elevations, originally in the possession of other clans or bands, were seized and added to the city, as its population and importance increased.

But the Palatine continued to the end to be the seat of imperial power, and it is at this present day the strangest possible mixture of wild nature and the magnificent erections of the greatest of the world's monarchs. Old Rome lay mainly on the

hills, out of reach of floods and malaria. Modern Rome has gone down into the hollows partly filled with rubbish shot from the hills, and incapable of good drainage, because so porous and saturated with the filth of ages. Modern Rome was until lately an unhealthy, malarious place; but under the new Italian government many important sanitary improvements have been made, and others are in rapid progress. It would be a good project,—now indeed in process of realization,—to transfer the city bodily to the table-land to the south, where there has already been much building, and leave the old site altogether to the excavators and the archæologists. At present the Palatine and the Forum are actually in this condition, and present a strange spectacle of ancient and grand ruins in the midst of a modern town.

The Jewish, and probably the Christian, quarter of Imperial Rome was that along the foot of the Janiculum, on the western side of the river, directly opposite to the Palatine hill. Looking from this to the Palatine, and restoring in imagination its magnificent palaces, one can imagine how it appeared to the persecuted Christians of the first century. On that hill reigned the master of the world, to whom all lives and fortunes were subject; whose word could consign to death or banishment the poor helpless Christians; and many times that word was spoken. The imperial court on the Palatine was the terrible impersonation of that great world-power which tyrannized over the Church of

God. It was the lineal and legitimate successor of those ancient conquering heathen empires which had from of old persecuted the people of God, and whose fated dominance constituted those "times of the Gentiles" which were to be fulfilled and finished by the coming of Christ Himself. Standing on the Palatine one can fully realize this, and can reconcile those crude applications of the apocalyptic prophecies to heathen Rome, in favour with some modern German theologians and their followers, with those wider views which can see in the Vatican the predestined successor of the Palatine.

One is struck in the Catacombs, and in the collections in the Lateran Museum taken from them, with the frequency of reference to such Old Testament stories as those of Daniel in the lions' den, and of the three Hebrew youths in the fiery furnace, It is impossible not to connect these with the idea in the minds of the early Christians that Rome was Babylon revived, and the emperor who reigned in the Palatine the counterpart of Nebuchadnezzar. These representations are in fact the same identification of Rome and Babylon which one sees in the Apocalypse of St. John, though there is no direct connection between the two, nor apparently much direct reference to the Apocalypse[1] in the figures in the Catacombs. Thus we can connect the identification on the part of the early Christians of the

[1] The frequent use of the letters Alpha and Omega, as an emblem of Christ, is probably a case of this kind.

Roman imperial power with Babylon with that designation of the new spiritual power which was to rise on its ruins by the same term in the Revelation of St. John. At a later time the removal of the new Christian empire of Constantine to Constantinople, while it really contributed to the development of the Papal power, may have seemed to be a mode of avoiding the fated connection of the old city with the rise and dominion of Antichrist.

In this connection it is also of interest to note, that while the old Testament prophets make comparatively few references to volcanic phenomena, and the classical writers seem to have little idea of the volcanic character of Central Italy,[1] volcanic phenomena are prominent in this connection in the prophetic literature of the New Testament.

Peter takes the lead in this at the day of Pentecost, when he quotes one of the few volcanic references of the prophets in that sublime passage of Joel:—

> ———"Wonders in the heaven above,
> And signs in the earth beneath;
> Blood, and fire, and vapour of smoke:
> The sun shall be turned into darkness,
> And the moon into blood."[2]

But in the Apocalypse this kind of imagery receives its full development. In the opening of

[1] Strabo recognises the volcanic origin of old craters in Southern Italy.

[2] Acts ii. 19.

the sixth seal, referring probably to the final overthrow of the imperial heathen power reigning on the Palatine, "there was a great earthquake; and the sun became black as sackcloth of hair, and the moon became as blood; and the stars of heaven fell unto the earth as a fig tree casteth her untimely figs."[1] One would suppose that the prophet had before him an eruption of Vesuvius—the preceding earthquakes, the black pall of ashes darkening the sun, the red glow of volcanic dust tinging the moon; the showers of hot volcanic stones, the disappearance of the heavenly bodies, the shaking of the mountains and islands out of their places. To his view it is evidently as if a new volcano had burst forth between the Alban and Ciminian Hills, and overwhelmed and engulfed the imperial city. Again, under the second trumpet,[2] he sees a burning mountain cast into the sea, and the third part of the sea reddened like blood with its ferruginous ashes, and the living creatures that were in the sea floating dead upon the surface. The phenomena here are those of a new submarine volcano, like that which burst forth in the Mediterranean in 1831, and was known as Graham's Island. A little later[3] he sees the pit of the abyss opened, and smoke issuing therefrom, darkening the air and the sun. Still later he pictures a great earthquake,[4] "such as was not since men were upon the earth," which shakes to pieces

[1] Rev. vi. 12. [2] Rev. viii. 8.
[3] Rev. ix. 1. [4] Rev. xvi. 18.

the nations that had taken the place of Rome. Finally, after defining the apostate Church that is to succeed heathen Rome, he pictures her destruction under the emblem of a burning whose smoke shall ascend for ever and ever, and under that of a great volcanic crater, "a lake of fire" into which she and her abettors shall be cast.

That these figures are not at all Palestinian, but are borrowed from the volcanic phenomena of the Mediterranean basin, no one can doubt. But did the prophet actually believe that the great world powers reigning and to reign in Italy, were to be destroyed literally in this way? The answer, I think, should be, that he merely employs phenomena characteristic of the site to depict a destruction of another kind, but to point out its terrible and total character as a retributive Divine judgment. Nevertheless, we need not forget that Italy is a volcanic region, subject to such phenomena as he has described, and that within the first century of the Christian era, and in the time of John the Apostle, disturbances occurred in Southern Italy which locally vindicate his descriptions, and which show that it is not impossible that even the extinct volcanoes of the central part of the peninsula may yet break forth in destructive eruptions.[1] It may be well in this connection to glance at these modern

[1] This has some bearing on the questions that have been agitated respecting the date of the Apocalypse. The external testimony of the oldest authorities is to the effect that John

phenomena, as picturing to us what was before the mind of the apocalyptic writer, as well as giving an idea of the appearances of the fire-belt, manifest more or less to successive generations of men in Southern Europe from the Pleistocene age to the present day, when destructive earthquakes are still reminding us of the instability of the lands lying above this great line of fracture.

It is farther south than Rome, on the fair Bay of Naples, that we shall find our best modern illustrations; and perhaps no volcanic region is more instructive to the geologist and historian than that which centres around Mount Vesuvius (Fig. 4). In ascending this mountain and noting its vast proportions, and the magnificent views from the winding road that leads from Resina to the summit, or to

was banished to Patmos in the reign of Domitian; and in that case his apocalyptic visions will date about A.D. 96. It has, however, been maintained on supposed internal evidence, that the book must have been written much earlier, in the reign of Nero, and some time before the great volcanic outburst in Southern Italy. The earlier date would oblige us to suppose some prophetic intimation to John of the approaching cataclysm. The later date would enable us to suppose that writing at a time when this great disaster, and possibly accompanying disturbances in the Greek islands, were fresh in men's minds, he availed himself of these well-known facts to illustrate the Divine judgments. The question is important, as the interpretation of the book has been made to depend on its date; and in this case the old Church historians and the more orthodox commentators favour the later date, and are more in accordance with the physical probabilities.

the station of the steeply inclined railway that facilitates the ascent, the geologist is deeply impressed with the fact that all he sees is absolutely modern. The road is cut through rocks of black lava, marked on his map as belonging to the eruptions of 1854 and 1872. The former has already acquired the aspect of an old rock. The latter has a comparatively fresh appearance, and shows a strangely gnarled and contorted surface, as if a troubled sea of viscous matter had been suddenly cooled. It is dark, highly vesicular lava, often scoriaceous on top. About half-way up, a spur of older material projects through the lavas which have flowed on both sides of it, and exhibits, among other things, a conglomerate of rounded volcanic and other stones, ejectamenta of the volcano, but which in another ocality might be attributed to the action of ice. Here is placed the observatory in which Signor Palmieri and his assistants keep watch over the

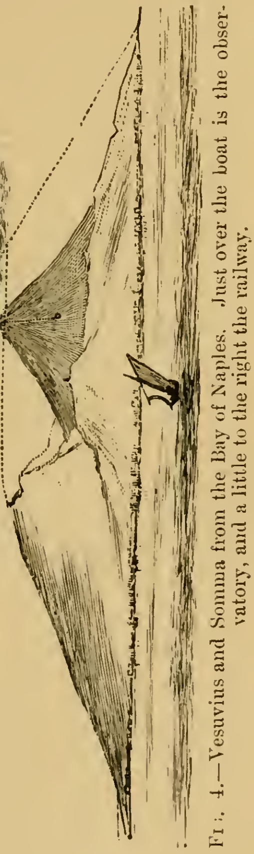


Fig. 4.—Vesuvius and Somma from the Bay of Naples. Just over the boat is the observatory, and a little to the right the railway.

fitful and dangerous monster. The crater itself, the rim of which is about 4,000 feet above the bay, varies in form and dimension (Fig. 5). When I visited it in the winter of 1883, it was a nearly circular depression, or deep hollow, in the mountain top, less than a quarter of a mile in diameter, and with a miniature mountain or interior cone, from which issued clouds of white steam, smelling strongly



FIG. 5. The Crater of Vesuvius, as seen in December, 1883.

of hydrochloric and sulphurous acids, and at short intervals emitting sudden puffs which carried up with them into the air masses of red-hot and semi-fluid lava, which fell around with a soft thud, and flattened themselves on the ground. For a few moments they were soft enough to allow the guides to insert coins into them as memorials of our visit. Standing on the rim, one could see the more recent lava currents radiating from the centre, some of

them running westward to the sea, others toward the Atrio de Cavallo, which lies between the mountain and the old cliff or escarpment of Mount Somma, the predecessor of Vesuvius. Conspicuous among these are the currents of the great eruption of 1872.

I was not so fortunate as to witness any more extensive eruption than the series of puffs to which I have referred, and which constitute the ordinary action of the volcano, but I give a copy of a photograph of the eruption of 1872, with a plan taken from an interesting paper by J. M. Black, F.G.S.,[1] from whose description the following summary is mainly taken (Fig. 6, and cut facing chapter).

On Tuesday, April 23rd, 1872, the volume of vapour from the mountain gradually increased, and until the 26th continued to increase until it assumed stupendous proportions, rising to four or five times the height of the mountain, or about 17,000 to 20,000 feet, and consisting of successive rolls or masses of vapour, representing the almost continuous explosions taking place from the crater. At night the vapour was invisible, but gave place to what seemed great tongues of fire, rising up many hundreds of feet above the summit of the volcano, and consisting of the red-hot stones and other ejectamenta cast out in the explosions. At the same time the lava poured out from the crater and flowed down the sides, appearing as fiery streams by night, and covered with thick clouds of vapour

[1] Proc. Geol. Association, 1874.

by day. All this was accompanied by rumbling sounds resembling distant thunder, and by continual trembling of the whole mountain to its base. Early in the morning of the 26th, a rent or fis-

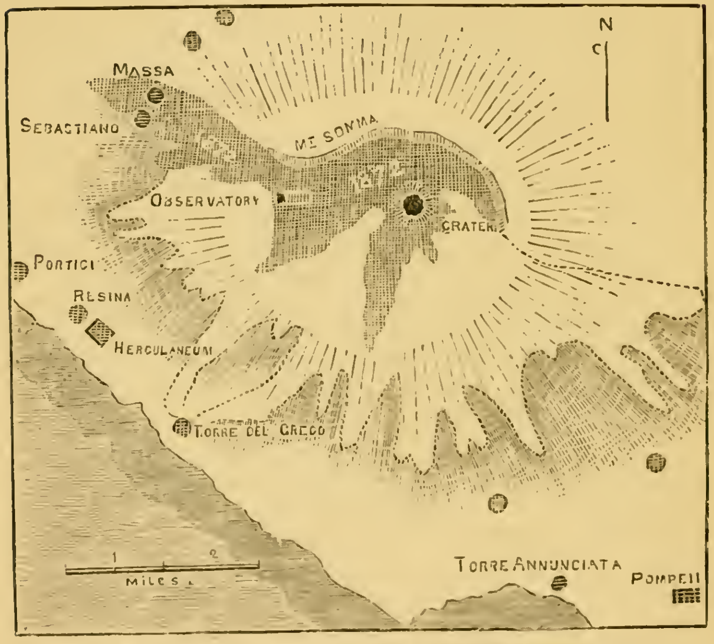


Fig. 6.—Map of the Lava Currents of Mount Vesuvius in the Eruption of 1872 (after Black). Lava of 1872 shaded with cross lines.

sure opened from the top of the cone towards the Atrio de Cavallo, and from this a great volume of lava poured forth. At the same time a similar rent took place at the southern side, and from this also a stream of lava issued toward the Bay of Naples.

The formation of these fissures was accompanied by an explosion of unusual violence, throwing great blocks or bombs of lava to a great height in the air, and with a vast evolution of vapour. Two great streams of lava were thus poured forth, one filling up the Atrio de Cavallo and pouring out westward in two branches on both sides of the observatory ridge, to a distance of four miles from the crater, the other running south half-way to the shore of the bay. The northern part of the first stream overwhelmed and destroyed a party of spectators who had taken up their position in the Atrio, and ran west to the village of Sebastiano, part of which it destroyed. This was the culmination of the eruption, but it continued on following days to the end of the month of April, and more especially discharged great showers of ashes, which darkened the sky and covered the ground as far as Naples, the wind having changed to the eastward. The loss of life in this eruption was not great, being estimated at between fifty and sixty persons, but there was great destruction of property, more especially in the farms and vineyards on the slopes of the mountain.

Black notes that the people were to be seen making processions, each bearing a picture or image of San Gennaro or Januarius, the patron saint of the mountain, to whom fervent prayers for protection were addressed—a strange example of another apocalyptic statement, that no exhibition of Divine power in nature can make the idolatrous repent of their idola-

tries, and a remarkable illustration of the permanence of old superstitions; for there can be no doubt that the same thing would have been done by their ancestors, four thousand years earlier, only that their processions would have borne images of now forgotten divinities, and their petitions would have been addressed either to the demons of the abyss, who might be supposed to be unusually active, or to the heavenly gods, who might be imagined to have the power of confining these evil spirits again in their underground prison. In both cases offerings would be made to appease or propitiate the evil or the good powers. Thus the effect of these grand natural phenomena has been the same on the uninstructed and debased human mind for thousands of years.

A few words may be pardoned here as to what we know of the nature and causes of these tremendous phenomena, and the light which they throw on the interior structure and genesis of the earth.

Perhaps the most striking fact to an observer on the top of Vesuvius, is the evidence that in the pipe or shaft terminating in the crater there is a column of molten rock extending from the summit not merely to the base of the cone, but for an unknown depth into the stratified rocks below, which, in the case of Vesuvius, are known to be composed of volcanic ash rocks, silts and marls of Tertiary dates, and below these, cretaceous limestones to a depth of 2,250 feet. But far below this, the well of fiery rock

must reach through older stratified rocks, down to where the earth's under-crust consists of intensely heated and soft or pasty material, forced upward by some enormous pressure into the volcanic orifice.

What is this pressure? It can surely be nothing else than the weight of the overlying crust itself. Let us suppose a fissure or crack formed in the earth's solid crust down to the molten layer and sediment deposited on one side, so as to weigh it down, or let us suppose a lateral pressure set up by the shrinkage of the interior and the settlement of the crust. In either case an enormous pressure may be put on the solid matter below, and it may be caused to well up through any crack or opening accessible to it. Thus the molten lava is really a portion of the inner or underlying heated matter of the earth squeezed out by pressure. But this might produce merely a quiet flow of lava. Whence is the explosion or violent action? Here another force comes into play, that of steam. The heated column is forced up through water-soaked rocks, and as it passes porous beds, quantities of water are injected into it, and as they ascend and are relieved from pressure, these successively flash into steam, producing reports or explosions. In addition to this, when any fissure is formed sufficiently extensive to admit sea-water, still more explosive action may occur, and as the water will be forced back at each explosion, and return after an interval, these explosions may take place in rapid succession and with

tremendous violence.[1] In short, in volcanic phenomena the actual power of ejection resides in the pressure of the crust, the noise and explosion in the steam produced by the heat of the ascending lava.

The enormous quantity of steam ejected from volcanoes, which in the case of Vesuvius has been estimated as equal to more than 200 millions of cubic yards of water in a year,[2] shows the great importance of water with reference to volcanic action. In like manner, the immense volume of hydrochloric and sulphurous acids seems to bear testimony to the fact that much of this water is saline, probably sea-water, holding salt and gypsum in solution, and the sodium and calcium of these salts must combine with the lava and increase its fusibility, as well as render it chemically more basic. This fact is also important in connection with the alteration or metamorphism which is found to have taken place in limestones and siliceous rocks, of which great quantities of blocks are ejected by Vesuvius, and have been described by Professor Guiscardi and Dr. Johnston Lavis, in whose collections I have seen fine examples of them. These rocks have evidently been acted on by heat and heated water under pressure, and the water has been sea-water, affording new materials to the rocks which it has penetrated.

[1] See papers by Prof. Prestwich, Proc. R.S., and by Dr. Johnston Lavis, Proc. R. Dublin Soc., 1886, Journal Geological Society, 1884.

[2] Cavallieri.

Thus the action of Vesuvius explains local metamorphism, and, when rightly considered, goes far to explain regional metamorphism as well. It may also enable us to appreciate that old belief, founded perhaps on ancient volcanic phenomena, that while the surface of the earth yields bread, "underneath it is changed as by fire."[1] The scientific basis of this belief only enables us to state it in a more detailed way.

It is popularly supposed that we know nothing of the earth's interior beyond a superficial crust, perhaps averaging 50,000 to 100,000 feet in thickness. It is true we have no means of exploration in the earth's interior, but the conjoined labours of physicists and geologists have now proceeded sufficiently far to throw much inferential light on the subject, and to enable us to make some general affirmations with certainty; and these it is the more necessary to state distinctly, since they are often treated as mere subjects of speculation and fruitless discussion.

(1) Since the dawn of geological science, it has been evident that the crust on which we live must be supported on a plastic or partially liquid mass of heated rock, approximately uniform in quality under the whole of its area. This is a legitimate conclusion from the wide distribution of volcanic phenomena, and from the fact that the ejections of volcanoes, while locally of various kinds, are similar in every part of the world. It led to the old idea of a fluid

[1] Job xxviii. 5.

interior of the earth, but this is now generally abandoned, and this interior heated and plastic layer is regarded as merely an under-crust.

(2) We have reason to believe, as the result of astronomical investigations, that, notwithstanding the plasticity or liquidity of the under-crust, the mass of the earth—its nucleus as we may call it—is practically solid, and of great density and hardness. Thus we have the apparent paradox of a solid yet fluid earth; solid in its astronomical relations, liquid or plastic for the purposes of volcanic action and superficial movements.

(3) The plastic sub-crust is not in a state of dry igneous fusion, but in that condition of aqueo-igneous or hydro-thermic fusion which arises from the action of heat on moist substances, and which may either be regarded as a fusion or as a species of solution at a very high temperature. This we learn from the phenomena of volcanic action, and from the composition of the volcanic and plutonic rocks, as well as from such chemical experiments as those of Daubrée, and of Tilden and Shenstone.

(4) The interior sub-crust is not perfectly homogeneous, but may be roughly divided into two layers or magmas, as they have been called: an upper, highly siliceous or acidic, of low specific gravity and light-coloured, and corresponding to such kinds of plutonic and volcanic rocks as granite and trachyte; and a lower, less siliceous or more basic, more dense, and more highly charged with iron, and corre-

sponding to such igneous rocks as the dolerites, basalts, and kindred lavas. It is interesting here to note that this conclusion, elaborated by Durocher and von Waltershausen, and usually connected with their names, appears to have been first announced by John Phillips, in his "Geological Manual," and as a mere common sense deduction from the observed phenomena ot volcanic action, and the probable results of the gradual cooling of the earth. It receives striking confirmation from the observed succession of acidic and basic volcanic rocks of all geological periods and in all localities. It would even seem, from recent spectroscopic investigations of Lockyer, that there is evidence of a similar succession of magmas in the heavenly bodies, and the discovery by Nordenskiöld of native iron in Greenland basalts, affords a probability that the inner magma is in part metallic.[1]

(5) Where rents or fissures form in the upper crust, the material of the lower crust is forced upward by the pressure of the less supported portions of the former, giving rise to volcanic phenomena, either of an explosive or quiet character, as may be determined by contact with water. The underlying material may also be carried to the surface by the agency of heated water, producing those quiet dis-

[1] These basalts occur at Oyifak, Greenland. Andrews has found small particles of iron in British basalts. Prestwich and Judd have referred to the bearing on general geology of these facts, and of Lockyer's suggestions.

charges which Hunt has named crenitic. It is to be observed here that explosive volcanic phenomena, and the formation of cones, are, as Prestwich has well remarked, characteristic of an old and thickened crust; quiet ejection from fissures and hydro-thermal action may have been more common in earlier periods, and with a thinner over-crust.

(6) The contraction of the earth's interior by cooling and by the emission of material from below the over-crust, has caused this crust to press downward, and therefore laterally, and so to effect great bends, folds, and plications; and these, modified subsequently by surface denudation, constitute mountain chains and continental plateaux. As Hall long ago pointed out, such lines of folding have been produced more especially where thick sediments had been laid down on the sea bottom. Thus we have here another apparent paradox, namely, that the elevations of the earth's crust occur in the places where the greatest burden of detritus has been laid down upon it, and where, consequently, the crust has been softened and depressed. We must beware, in this connection, of exaggerated notions of the extent of contraction and of crumpling required to form mountains. Bonney has well shown, in lectures delivered at the London Institution, that an amount of contraction almost inappreciable in comparison with the diameter of the earth, would be sufficient; and that as the greatest mountain chains are less than $\frac{1}{600}$th of the earth's radius in height, they

would, on an artificial globe a foot in diameter, be no more important than the slight inequalities that might result from the paper gores overlapping each other at the edges.

(7) The crushing and sliding of the over-crust implied in these movements raise some serious questions of a physical character. One of these relates to the rapidity or slowness of such movements, and the consequent degree of intensity of the heat developed, as a possible cause ot metamorphism of rocks. Another has reference to the possibility of changes in the equilibrium of the earth itself as resulting from local collapse and ridging. These questions in connection with the present dissociation of the axis of rotation from the magnetic poles, and with changes of climate, have attracted some attention, and probably deserve further consideration on the part of physicists. In so far as geological evidence is concerned, it would seem that the general association of crumpling with metamorphism indicates a certain rapidity in the process of mountain-making, and consequent development of heat; and the arrangement of the older rocks around the arctic basin forbids us from assuming any extensive movement of the axis of rotation, though it does not exclude changes to a limited extent.

We may popularize these deductions by comparing the earth to a drupe or stone-fruit, such as a plum or peach, somewhat dried up. It has a large and intensely hard stone and kernel, a thin pulp

made up of two layers, an inner more dense and dark-coloured, and an outer less dense and lighter coloured. These constitute the under-crust. On the outside it has a thin membrane or over-crust. In the process of drying it has slightly shrunk, so as to produce ridges and hollows of the outer crust, and this outer crust has cracked in some places, allowing portions of the pulp to ooze out—in some of these its lower dark substance, in others its upper and lighter material. The analogy extends no further, for there is nothing in our withered fruit to represent the oceans occupying the lower parts of the surface, or the deposits which they have laid down.

Returning to the historical and biblical connections of our subject, we have already seen that Vesuvius is a modern volcano. All this mass of solid rock and consolidated ash and scoria, 4,000 feet high and about three miles in diameter, has been extracted from the bowels of the earth and piled up since the year 79 of the Christian era, or say, in about eighteen centuries. According to Dr. Johnston Lavis, one of our best authorities on Vesuvius, we should add to this the filling of a vast conical cavity left by the great eruption of the year 79. We should also add those thick beds of ashes and lapilli with which a large area in Southern Italy was covered at the time of this eruption.

As seen from Naples or from the bay, Vesuvius appears to be a regular cone, with a second mountain

about three-fourths as high at its north side. This second mountain slopes away to the north, and presents a steep front towards Vesuvius, as if it was a remnant of a similar but larger cone, of which the greater part had been removed. When we get a panoramic view of the mountain from the rim of the crater, this conclusion is confirmed by our perceiving that the accessory mountain, known as Monte Somma, is of a crescent shape, enclosing in its curve nearly one-half of Vesuvius; and the Observatory Mount, and portions of the Piedemontana or Foot-hill on the other side are evidently continuations of the same great curve. Besides, we can see that the escarpment of Monte Somma consists of bedded volcanic matters of the same nature with those of Vesuvius, except in some particulars well noted by Dr. Johnston Lavis, and which show its older date. On tracing the margin of this outer curve, we find that it is about six miles in diameter, corresponding to the foundation of a hill twice as large as Vesuvius. (See Fig. 4, p. 61, dotted line.)

Let us suppose, then, the present cone removed and the old circle of Somma raised to its pristine elevation. It would then form, according to my friend Dr. Lavis, a cone 7,000 feet in height. Such a mountain, though probably broader at top and not so high in proportion as the modern Vesuvius, we know from history existed here from the first colonization of Italy till the year 79 of the Christian era, and showed no signs of volcanic activity; though,

had there been geologists in those days, they would have concluded that it had once been a volcano.

By studying the series of deposits presented by the wreck of this old mountain, we can learn more of its history than was known to the ancients. The cliff which bounds the Atrio de Cavallo is seen to consist of regular volcanic beds. These rest on marine sediments, with sea-shells of pleistocene date, and including layers of volcanic ashes, which show that Somma began its eruptions as a submarine volcano in a shallow sea, at the time of the pleistocene submergence, when the Mediterranean was wider than at present; though at a later date, in the continental Post-glacial period, it must have stood far within the limits of the land. The underlying beds are seen in wells in its vicinity, and fragments holding fossils have been found by Guiscardi in the blocks mixed with the old volcanic ejections. Below these pleistocene beds the ejected blocks show that there are eocene beds and thick limestones of the age of the English chalk, and below these still there would seem to be old crystalline rocks.

What was the condition of Somma in the antediluvian period we do not certainly know, since no remains of that age have yet been found in its beds; but it is not impossible that the first palaeocosmic colonists who found their way to the greater Italy of those days may have seen it as still an active volcano. Those grand old men of great stature, whose bones and stone implements are found in the caves at

Mentone, and in whose days the volcanoes of Central Italy were certainly still alive, may, if they extended their travels so far south, have seen Somma still smoking above the forests which clothed its base. However this may be, when the first post-diluvian colonists of whom we have any record landed in Italy, the mountain showed no signs of activity, and was clothed to its summit with the rich verdure which in that climate luxuriates on the fertile volcanic soils; though at that time there were active volcanoes in Ischia and the Phlegrean fields. Somma remained a beautiful and symmetrical feature in the landscape through all the periods of Greek and Roman history, till the fated year 79, when it burst forth in that frightful eruption which destroyed Pompeii and Herculaneum, and brought death and desolation to all the country around the Bay of Naples, but which had the effect of preserving to our time, in the buried cities, treasures of art which have better illustrated the social life of ancient Italy, and have afforded more available models to modern designers than have been furnished by any other ancient sites. Pliny the Younger, as an eye-witness, well described this great eruption, whence it is sometimes known as the Plinian eruption. In modern times Poulett Scrope, Lyell, Mallet, Phillips, and many Italian geologists have studied its geological features. I shall here refer merely to some points of more general interest.

The Plinian eruption, representing pent-up forces

which had been accumulating for ages, was preceded by violent earthquakes, after which one mighty effort literally blew into the air the whole mass of Somma, and scattered its fragments over all parts of the surrounding country. Its principal force was expended a little to the south of the axis of Somma, and it is for this reason that the north side of the old volcano is the best preserved. According to Lavis, the first effect of this eruption must have been to leave a great gulf or conical cavity, which, if its bottom was filled with molten lava, probably gave to men the earliest realization of a "lake of fire," now made familiar to us by the still grander crater of Kilauea in the Sandwich Islands. Out of this abyss rose, by the accumulations of successive eruptions, the modern cone of Vesuvius, which has never since been entirely quiescent.

The rise of this mighty mountain in modern times furnishes an apt illustration of igneous forces, and of the rapid rate at which they can effect changes; and we should bear in mind that, besides Vesuvius, Southern Italy and Sicily are full of examples of somewhat abrupt geological change, and in this respect are quite in contrast to our staid and settled northern regions of old and stable rocks. It is also a marked illustration of sudden and cataclysmic action, proceeding from the slow and continued accumulation of forces during long ages of apparent quiescence. All earthquakes belong to the same category with reference to their causes; and in this

same region the recent destructive shocks at the old volcanic island of Ischia, whose active volcanic phenomena belong to the early historic period, show the same cumulative tendency, the evidence going to show that the seismic shocks were a residual effect of the old volcanic action.

Another interesting thought in connection with Vesuvius relates to what may be termed mountain-making. Vesuvius itself is an example of a mountain built up, like a mole-hill, of matter taken out from below and piled on the surface. In the Apennines and sub-Apennine hills, on the other hand, there are mountain masses built up of nearly horizontal beds of limestone and sandstone, which have been elevated bodily, as parts of very flat curves of the crust, and have afterward been sculptured by the sea, or by atmospheric waters eating away their softer parts. Lastly, the great peaks of the Alps and certain central parts of the Apennines show vast crumplings and foldings of the rocks which have been thrust upward by the lateral pressure of the contracting crust. All of these processes have been going on from the beginning of geological time, but it is to the last that the greatest and most extensive mountain ranges are mainly due. Still, we see that while all mountains have histories, these may differ in different cases, and in the greater mountain chains are variously combined. In connection with all this we must take into consideration the fact that most mountains, and especially the

older ones, have been more than once wholly or partially submerged and re-elevated, and that these dips and emergences have contributed by sea agency to their moulding into their present forms.

The explosion of Somma and the origin of Vesuvius are the latest of the grander volcanic phenomena of the Mediterranean. There has been nothing so tremendous since; but there is evidence of earlier catastrophes of equal extent. Similar eruptions probably produced the old craters of Avernus and Albano in Central Italy, and the still more magnificent ruined crater ot Santorin in the Greek Archipelago, though new mountains have not succeeded these, except in the case of the little volcano of Neo-Kaimena, in the latter case. The eruption of Santorin may, like that of Somma, and the modern catastrophe of Krakatoa, have reddened the skies of the whole world by its fine ashes cast up into the upper atmosphere; and though this eruption was prehistoric, there are some reasons to believe that antediluvian men may have witnessed it, and derived from it impressions never forgotten by their descendants.

I have referred to one of the most strange and beautiful accompaniments of volcanic phenomena—that of the brilliant afterglow which was so apparent in all parts of the Northern Hemisphere in the autumn and winter of 1883-4, and which we saw in its full perfection in Egypt, when, in the cloudless atmosphere of the Upper Nile, its beauty and dura-

tion were remarkable, and an ever-attractive evening spectacle of transcendent loveliness. One evening, in returning over the desert to Suez, the setting sun was filling the western sky with this roseate light, tinging with a red illumination one side of every rock and building, while the nearly full moon was rising in the east, whitening with silver light the opposite side. The effect was magical, the whole landscape being refined, as if it had put on a new and spiritual beauty; and this, with the deep blue of the sea and warm tints of the limestone cliffs, produced altogether the most unearthly and beautiful evening spectacle I ever witnessed. The sun-glows are now relegated by unpoetical science to the domain of dust, and it seems that the uniform diffusion of fine particles in the upper atmosphere is all that is required to produce them. In Egypt the dust of the desert, in windy weather, rises high in the air and gives it a ruddy tint, and the same effect is produced by the smoke of forest fires in America. The brilliant sun-glows of the winter of 1883-4 were attributed to the great eruption of Krahatoa, which threw up to a vast height in the atmosphere volumes of the finest dust; and this, floating for a long time in the upper air, acted on the solar light. Thus the effects of the eruption were world-wide.

It is believed that since the great eruption of the year 79, the Italian volcanoes have done little in this way except at the time of the eruption of

Graham Island, in the Mediterranean, when similar phenomena are said to have manifested themselves locally. Such things impressed the imaginations of men in early times, and while they terrified the ignorant and superstitious, and were interwoven with their idolatries and myths, served to intensify the warnings of prophets, and to supply them with emblems illustrative of the terrible nature of God's judgments on human wickedness—emblems which, to those acquainted with their reality as natural facts, possessed a commanding force and significance.

These considerations lead us to see something of the discipline afforded by physical surroundings to the early tribes of men, who, migrating slowly westward along the Mediterranean shore, were witnesses to some of the more striking natural processes by which the continents are fashioned, who learned to think of these great processes as the results of superhuman agencies, and whose imaginations were stimulated and their minds quickened by the energies of nature around them. We can scarcely estimate the extent to which art and literature are indebted to the subterranean energies of the fire-belt; and we can at least better appreciate the use made of these energies as symbols of the judgments of God in the concluding book of the New Testament.

But the great Plinian eruption has a further human interest in the desolation which it wrought in Southern Italy, and in the evidences of this which have been exhumed from the two buried

towns which, probably along with several others, were suddenly destroyed. They were not cast into the lake of fire, nor did the smoke of their burning ascend up for ever. That would have happened had they been built on the summit or southern slope of Somma; but they were on the margin of the area of volcanic action, and so were merely buried out of sight till dug up by the spade of the excavator. The extent of the destruction which they shared may be estimated in this way. A line joining Pompeii and Herculaneum is about seven miles in length, and about three miles from the crater of Vesuvius. Even supposing that, owing to the direction of the wind, the destructive effects were confined to the country lying to the southward of the mountain, we shall thus have an area of, say thirty square miles of a very thickly peopled country entirely devastated, and a large proportion of its people destroyed.

The description of the eruption by Pliny in his letters to Tacitus corresponds very well with the deposits now exposed at Pompeii and Herculaneum. It would seem that, in the first paroxysms of the eruption, great quantities of pumiceous lapilli were thrown out, mostly small, but sometimes weighing more than five pounds. As the discharge proceeded, the material became finer and of the nature of volcanic ash. All these materials were projected into the air to a great height, and mixed with a cloud of steam, the explosion of which was the cause

of their ejection. As seen in the excavations at Pompeii, the resulting deposit is twelve to fifteen feet in thickness. The lower part consists of grey lapilli, with their interstices filled in with volcanic ash, which is similar material in a comminuted state. The upper part is finer and of a darker colour, with small concretions. It would seem that most of this material must have fallen in a dry state, but in the sequel of the eruption torrents of rain fell, converting the ashes into mud, and it is to this circumstance that we owe the formation of hollow moulds of the bodies of some of the victims of the catastrophe, which have enabled Signor Fiorelli to reproduce, in startling reality, the forms and features of several of the old Pompeians as they lay in the agonies of death. At Herculaneum this volcanic mud was hardened above into a stony bed of considerable thickness—a "lava d' acqua," as it is called by the Italians, which causes the excavation of that city to be a species of mining, but which has better protected its remains than those of Pompeii.

In Pompeii and Herculaneum we have fossil cities, and their state of preservation is very impressive, as an illustration of the possibility of such fossilization. We see in their streets and houses the remains of an ancient town, just as it was left by its inhabitants, who might have fled from it yesterday. In some of the better-preserved rooms and shops we would scarcely be surprised to be greeted by one of the old inhabitants with a hospitable *Salve!* But in most

there is a peculiarly mournful aspect of dilapidation, not like that of an old ruin, but like that of a house which has been on fire yesterday. The actual state of preservation is, that the roofs and all combustible parts were burned and fell in, the walls and all incombustible objects were packed full of lapilli and ashes, and buried out of sight. The style of art in utensils and decorations speaks of a high civilization, far superior to that of Europe in the Middle Ages, and which has afforded the models of a remarkable number of modern ornamental objects. The Pompeian Museum at Naples, in fact, would make one believe that three-fourths of our modern artistic decoration had come from Pompeii, or from the same sources with the art of that fossil city. Among exceptional fossils we note the charred rolls of parchment from Herculaneum, which can still be opened by careful manipulation and read. One of these, on exhibition when we were there, was a Latin encyclopædia of philosophy and literature in many volumes, by an author little known to modern scholars, but which seems to have formed a main part of the library of some gentleman of Herculaneum. Still more wonderful as fossils are the plaster casts secured from the moulds of the bodies of men and animals buried in the semi-fluid volcanic mud. One of these is peculiarly striking. It represents a Roman gentleman, who, perhaps ill and deserted by his attendants, perished in his bed. His fine Roman features and aspect of calm resigna-

tion are in strong contrast to most of the other figures of this kind (Fig. 7). He has no name, but as we wandered through the town, we came to a house called that of Cornelius, and saw facing us in the atrium a marble bust, inscribed, C. Cornelius Rufus, which we recognised as the face of our friend of the Pompeian Museum. We were told that it was in this house that the mould of the body was found; and if so, we have here an unusual opportunity of realizing, both in marble and in an actual cast, the aspect of a Pompeian of the first century. He was certainly a good representative of that noble Cornelian gens to which the Roman centurion, Peter's first Gentile convert, belonged. We may accept him as a relative and representative of that eminent man. We know not if he was a Christian or a heathen,

FIG. 7.

Cast of the Body of a Roman Gentleman who perished in Pompeii. (From a photograph.)

and cannot certainly divine whether the calm on his countenance is that of Christian hope or stoical resignation. In either case, he probably died with the thought in his mind that earth's final day as well as his own, had come, and that the world and all things therein were being destroyed. After all, the age of this Roman was modern, compared with those of Seti and Rameses of Egypt, whose faces we can now see in the flesh in the museum at Boulak; and such facts give us the hope that even yet some fortunate discoverer may bring before us the very form and lineaments of the earliest palæocosmic men, the ancestors of humanity, of whom we already know something from their skulls and the remains of their weapons and implements.

These thoughts remind us of something we have left behind at Rome. The Catacombs, excavated in the tufa mounds around that city, represent a new mode of burial, introduced with Christianity, which abhorred the old cremation, and believed in the more ancient Eastern idea of the decent preservation of the body until the resurrection. Further, as the mode of burial in catacombs was abandoned after the fourth century, these remarkable underground tombs belong to the earlier three centuries of Christianity. The bodies placed in them have perished, all except the bones, and even they are often poorly preserved; but the simple Christian faith of the inscriptions remains as a legacy to all time, testifying that there is something more important in the

preservation of the thoughts of men than merely of their bodies, impressing us with the intense earnestness and simplicity of the faith of the early Christians, and their implicit belief in the Bible; and also, by the vast number of interments, estimated at four millions, with the marvellously rapid progress of the gospel in the metropolis of the Roman Empire in the early centuries of the Christian era. This great host of witnesses lies encamped around Rome, and will arise in the latter day to testify to the essential truths of Christianity, and to bear witness against its more modern apostasy.

Lastly, we may note the fact that the deposits in which the Roman catacombs are excavated are essentially of the same nature with those which bury Pompeii and Herculaneum, but of older date, and thrown down in shallow water, rather than on dry land. If, in the future, the volcanoes of Central Italy should, like old Somma, renew their activity and absorb the Tiber and the imperial city in their central lake of fire, these old Christian tombs will experience a new and deeper burial. Perhaps the existence of these Christian sepulchres, and the fact that the Italian capital contains many more than ten righteous men, constitute the surest guarantees against the literal realization of the volcanic symbols of the Apocalypse.

The Waldensian Church of to-day is the true and uninterrupted successor of the Church of the Catacombs; and its evangelical congregations and schools,

scattered over Italy and daily growing in numbers, constitute the true Italian Church, and, without detraction from other Christian missions, the best guarantee for the exemption of Italy from Divine judgment, and for its advance in true religion and Christian civilization.



Outlines of three Palæocosmic skulls. Outer, Cro-magnon; second, Engis; third, Neanderthal (Canstadt type), compared with the skull of a village Indian from the site of Hochelaga, Canada. The latter within, and on a smaller scale.

CHAPTER III.

HAUNTS AND HABITS OF PRIMITIVE MAN.

One of the oldest and most interesting regions ot the world is that narrow strip of recent formations extending from Mount Carmel along the east end of the Mediterranean, northward to the ancient Aradus, and limited by the Lebanon mountains on the east, and the sea on the west. At some time, even before the migration of Abraham, the Phenicians are said to have emigrated from the shores of the Persian Gulf and occupied this strip of territory. The statement harmonizes quite well with the distribution of men recorded in the 10th and 11th chapters of Genesis; for the primitive abode of post-diluvian men in the land of Shinar skirted the Persian Gult, then more extensive northward than now. This wandering tribe, hemmed in by trackless mountains, but backed by the rich agricultural lands of Caele-Syria and Northern Canaan, and amply supplied with wood from the forest-clad hills, very naturally took to the sea, and that sea was the Mediterranean, with all the natural riches of Europe, Asia, and Africa lying around it, and affording what at that time

must have seemed boundless scope for trade and colonization. Thus Phenicia became the first great maritime power, and led the way in that long succession of sea-faring and trading nations of which our own English race is no unworthy representative.

But who were on this coast before the Phenicians? When Abraham entered Palestine, more than 2000 B.C., the Canaanite was already "in the land"; but we are told of a still older race, the Rephaim, including the Horim, Emim, Anakim, and the like, who were apparently there before the Canaanites, and of whom no genealogy is given.[1] So it was also in Phenicia. Professor West, late of the American College, Beyrout, has given me an illustration of this from the site of ancient Sidon. In digging foundations for new mission buildings, just outside the city wall, the following section was exposed:—

City *débris*	6·80	mètres.
Sea sand	·50	,,
Earth, 40 to 80, say	·60	,,
Burnt earth	·30	,,
Dark earth with flint knives, marine and land shells of recent species still found on this coast, coarse pottery in unworn fragments, streaks of burnt earth . .	1·20	,,
Sandy loam, a few rounded pieces of pottery, fragments of sea shells .	1·10	,,
Red Sandstone rock, probably pleistocene, and about three metres above the sea	3·0	,,
Total	13·50	mètres.

[1] Deuteronomy, chap. ii.

Thus the rubbish of old Sidon had been cast forth on a bed of sand, probably blown sand, such as occurs in many places on the coast. Under this are indications of a fire, and below this the *débris* of a primitive station of Stone men. Putting into historical form the details given me by Professor West, we have here the indications of a pre-Phenician settlement, probably of wooden huts, inhabited by people who used beautifully chipped flint knives, long and slender, of which Professor West sent me an interesting specimen[1] (Fig. 8), feeding on the wild animals of the country, and on the large land snails and a variety of marine molluscs. The village of these poor people was burned, probably in a struggle with the

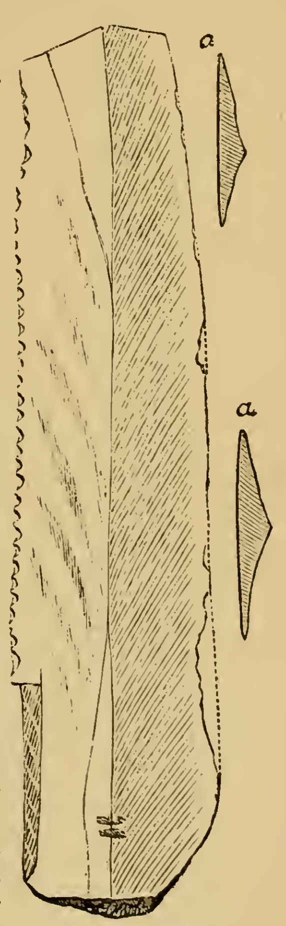


Fig. 8.
Flint Knife and Saw.
Site of Sidon.

[1] This knife is $4\frac{1}{2}$ inches long, and has probably lost an inch of the upper end. It is about an inch wide in the middle, and very thin. One edge has been sharp and even; the other is flaked into little teeth, fitting it for use as a saw. The fresh fracture is grey, the old surface of a rich brown colour.

colonists, and the vegetation which may originally have sheltered it from the sea being removed, it was covered with blown sand, and subsequently with rubbish from the town. This is not a solitary instance on this coast; but it is sufficient for our present purpose.[1] The primitive inhabitants, driven by the Phenicians from the coast, took to the hills, and dwelt in the caverns which abound in the limestone cliffs of Lebanon. Perhaps the rude population still living in the Northern Lebanon, and known as Nusairiyeh, may be their descendants. I had an opportunity of visiting one of their old caves of residence in the ravine of the stream known as Ant Elias, a little north of Beyrout. It is not a mere shelter, but a long tunnel penetrating far into the hill, and formerly excavated by a stream, but now, like many other river caverns in these hills, left dry by the water finding a lower level. Near the mouth of the cavern a tribe of aborigines must have lived for a long time, for, on digging into the floor, we found to the depth of two feet a congeries of flint knives and broken bones with helix shells,[2] and shells of a species of Turbo still living on the coast, and fragments of charcoal, the *débris* of their cookery and feasts. The

[1] I have described (Trans. Vict. Inst., 1884) a similar deposit of flint implements under blown sand on the rising ground above Beyrout, and which may indicate an aboriginal station occupying that commanding position before the foundation of the Phenician Berytus.

[2] *Helix pomatia*, a large variety still abundant in the vicinity of the cavern.

earth in this cave was loose, without any hard stalagmite, except at the sides. The bones which we collected showed that these people had hunted the deer, the wild goat, and other animals still living in the Lebanon hills, and collected molluscs on the land and on the coast. The material for their knives and weapons was supplied to them by the abundant flints in the cretaceous limestone of the vicinity. These remains belong to times anterior to the early migrations of the Semitic and Canaanite peoples; but they are all post-diluvian.[1]

The cliffs of this same coast of the Eastern Mediterranean carry us back to a still earlier population. The town of Beyrout, the ancient Berytus, is built on a little ridge of limestone rock, separated by a plain from the range of Lebanon. North of the Ras, or head of Beyrout, the coast sweeps inward in the beautiful Bay of St. George, and beyond this a strong spur of cretaceous limestone stretches out to the sea, near the Nahr-el-Kelb or Dog River, the ancient Lycus. This spur here blocks the way along the coast, and forms a maritime pass, which in ancient times was most difficult and dangerous to invading armies. Hence the successive conquering

[1] Lartet has noticed the occurrence of flint knives and chips at a number of places in Palestine; but they were all superficial and of uncertain age. I noticed numerous flint chips in the mound which covers the site of ancient Jericho. Careful digging will be necessary to distinguish remains really prehistoric from those which belong to the recent people, who we know used flint knives, up to the time of Joshua at least.

kings, from Rameses II. of Egypt down to the Roman emperors, have laboured to form a practicable road around the projecting point, and have inscribed on tablets at the mouth of the pass their names and titles. Even the French army of occupation ot 1860, without the merits of earlier workers, erased the inscription from one of these ancient tablets, and replaced it by one in their own honour. But in excavating the cretaceous limestone to form the road, a bed of different character was cut away, a stalagmite or calcareous deposit which had filled certain coast caverns, and had become as hard as the rock itself. Geological travellers, examining this material, found it to be full of flint knives and fragments of bones, the deposits of men who in some far back time had inhabited these sea-side caverns. Canon Tristram was the first English traveller to notice these interesting remains. I had an opportunity in 1884 to visit the place in company with Dr. Bliss of the Beyrout College, and the following description will enable the reader to understand the character of the formation exposed.

The Lebanon Mountains, composed as they are principally of horizontal or slightly inclined beds of limestone of different degrees of hardness, and traversed by many faults and fissures, are eminently suited for the production of caverns and rock shelters available for human residence, or for sheltering animals; and such caverns accordingly abound in most parts of the range, and have from the earliest

periods been employed for these purposes. These caverns are, with respect to their origin, of two kinds—river caverns and sea-cliff caverns.

The former have been excavated by streams running underground, along lines of fissure which they have enlarged into tunnels. A remarkable example of this kind is the grotto of the Nahr-el-Kelb river, which was explored in 1873 by Messrs. Marshall, Bliss, Brigstoke, and Huxley, and found to extend for 1,256 yards, and to expand into large halls with magnificent stalactites. Another is that from which the neighbouring mountain stream of Ant Elias issues like a gigantic fountain. These water-caves may ultimately become dry, by the streams finding a lower level, either in the rock itself or in some adjacent ravine, this being, perhaps, sometimes determined by the partial falling-in or choking of the cavern itself. In the ravine of Ant Elias, as already stated, in addition to the present water-cave, there is one which has become perfectly dry, and there are remains of others which have been cut into and unroofed by the further excavation of the ravine.

The second class of caverns,—those excavated by the sea,—may be seen in process of formation at many places on the coast, where the waves have cut into fissures, or have undercut the harder beds. They are usually not very deep, and are often mere shelters or overhanging ledges. Such caverns are frequent on the old inland cliffs which have been subjected to erosion when the land stood at a lower

level. The caverns now under consideration at the maritime pass belong to this latter class. The stalagmite contained in one of them was thus described by Canon Tristram, who explored it in 1864:—

"The position of this mass of bone was several feet above the height of the present roadway, but below the level of the ancient Egyptian track, and it has formed the flooring of an ancient cavern, the roof of which must have been cut away by Rameses to form his road, or to obtain a surface for his tablet. From the position of the deposit, it would seem as though the floor of the cave had once extended to the sea-face of the cliff, and that the remaining portion was excavated by Antonine for his road, leaving only the small portion which we examined." (He then notices the fallen masses of breccia which have been thrown down on the talus formed in making the road.) "The bones are all in fragments, the remains, in all probability, of the feasts of the makers of the rude implements. Four of the teeth have belonged to an ox somewhat resembling the ox of our peat-mosses, and one of them probably to a bison. Of the others, some may probably be assigned to the red-deer or reindeer, and to a species of elk."

Lartet has described the caves of this district in his geological report of the expedition of the Duc de Luynes, and Fraas has devoted some space to them in *Aus dem Orient*. The latter specifies, as found in these caverns, *Ursus arctos*, *Felis spelæa*, *Rhinoceros tichorhinus*, *Bos priscus*, *Sus priscus*, and remains of

Equus, *Cervus*, and *Capra*, an assemblage which may well be called prehistoric, even in a country whose history extends so far back as that of Syria. Lartet, who probably had explored only caverns of the age of that at Ant Elias, mentions only species of stag, goat, antelope, etc., all of them believed to have been found in the Lebanon in early historic times.

The evidently great age of the deposit at Nahr-el-Kelb Pass induced me to give much attention to it, more especially with reference to points not investigated by previous explorers, and I was fortunate in being able to compare its contents with those of the more recent though still very ancient caverns at Ant Elias. (Fig. 9.)

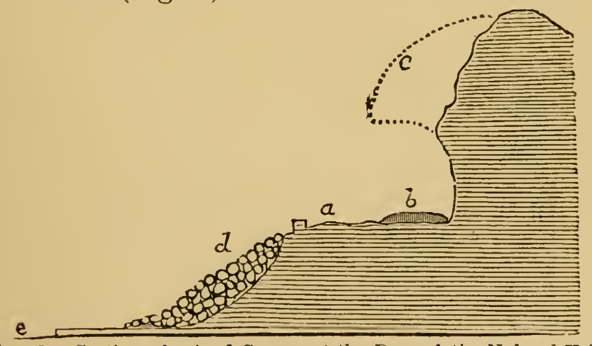


Fig. 9.—Section of ruined Cavern at the Pass of the Nahr-el-Kelb. (*a*) Bed of Road. (*b*) Breccia of Floor of Cave. (*c*) Probable roof of ancient Cave. (*d*) *Débris* thrown down in cutting the Road. (*e*) Level of Sea.

At the point in question, the present road, which is probably nearly identical with that cut by the Romans, is about 100 feet above the sea-level, from which the bank rises in a steep slope, composed

of fallen blocks of stone. The road bends inward into the cliff, which here recedes in a little cove facing the north-west, at the bottom of which was the cave. The remains of this consist of a stalagmite floor, about eighteen inches in its general thickness, extending inward from the road toward the cliff about six paces, and in breadth along the road about nine paces. The roof and sides of the cave are gone, but at the back the vertical cliff presents a sort of niche with the top slightly arched, and corresponding to the back of the cave, which must have been nine yards broad and of considerable height, with an arched roof. It has evidently been a sea-cave, excavated at the bottom of a small cove or indentation in the cliff, and at a time when the sea was about a hundred feet above its present level. Near the cave the cliff rises in a series of little terraces, on which grain had been sown; and over the top runs an old road or track, which seems to have been that in use when the early Assyrian and Egyptian tablets were cut on the rock, as they are evidently related to the level of this, and not to that of the present road.

Whether the roof of the cavern had fallen in before the Roman road was made is uncertain; but it is clear that the floor of the cave was cut into in making the road, and at least the *débris* of its sides and roof used in forming the bank, as large masses both of the stalagmite and of the limestone rock lie on the slope, some of the latter holding characteristic cretaceous corals, which belong to the soft

bed in which the cave was originally excavated. A large slab of the bone-breccia, eight feet in length, now forms part of the parapet of the road, and would make a magnificent museum specimen. The exposed surfaces of the stalagmite, and the pieces on the bank, were carefully searched for teeth and bones and flint knives, and the specimens found will be described in the sequel. Search was also made on the little terraces near the cave, and a few flint flakes were found, but no other signs of human occupancy. On the flat top of the cliff, over which the old track runs, nothing was seen. The cretaceous limestone has an anticlinal undulation at the locality of the caves, dipping west-south-west at one end, and north-east at the other.

In the same cove with Tristram's cave, a little to the south and thirty-five feet higher in the bank, another, though smaller, cave exists, with its roof still entire. The floor of this cave is of soft earth, and in digging in it nothing was found. Near the mouth, however, was an oval bed made of stones, lined with green rushes, on which some one had slept within a few days, furnishing an example ot the recent use of this cavern.

In the next adjoining cove to the south-west of Tristram's cave, Dr. Bliss was so fortunate as to find the floor of a second cavern still richer in remains than that of Tristram's cave, from which it is distant two hundred and ten paces along the road. Its roof is entirely gone, the material having apparently been

for the most part removed to form the road, though some large blocks remain. The stalagmite floor is ten paces broad, and in some places as much as four feet thick. It is somewhat softer, and of a more yellow colour, than that in the other cave; but its contents in bones and flint knives appear to be similar.

Between the two caves the road passes round a point of rock concealing the one from the other, and commanding an extensive view of the coast from Beyrout to Tripoli. At this point are the remains of a foundation of hard concrete, and near it a plain shaft of grey granite projecting from the parapet of the road, as if some monument had been erected, probably in Roman times, at this point.

It is to be observed that when these caverns were entire, and before any road was cut around the cliff, their occupants would enjoy a position difficult of approach by enemies, and commanding an extensive view along the coast. There would also be easy access to the foot and to the top of the cliff, and small terraces of ground capable of occupation and even of culture, and, in any case, of sustaining trees available for shelter and fuel. No running water is known nearer than the river, but there are cavities in the rock which retain rain-water; and if, at the time of the occupancy of the caverns, the land was higher than now, the flat country found at other parts of the coast may have extended around this promontory, and there may have been springs at the foot of the cliff. The ledges of rock at the foot of

these cliffs abound in limpets and other shell-fish, and at the time of my visit I saw boys engaged in collecting these. If the sea had been as near at the time of the occupation of the prehistoric caves, we should have expected that their inhabitants would have availed themselves of this source of food, and that numbers of shells would have been found in their kitchen-middens. As this is not the case, we have an additional reason to suppose that the sea was then distant. If, at the period in question, the maritime plain of this coast was much wider than at present, this would have enabled herds of horses and deer to migrate from north to south, and to find suitable pasturage, and would also have afforded fit haunts for the rhinoceros. It is evident, however, that any such condition of the coast must have been anterior to the times of Phenician history.

It is also probable that the caves may have been occupied occasionally, or at certain seasons, rather than continuously. The bones and knives are not merely covered with stalagmitic matter, but mixed with it, indicating that the deposit was in progress when these remains were being accumulated. This would also give evidence of a more moist climate than that prevailing at present, and probably a wooded condition of the country, such as that referred to in the descriptions of Lebanon in the Old Testament, and which must have continued from the earliest times till the hills were finally denuded of their trees by the agency of man.

Though it is possible that these caves may have remained intact until the cutting of the Roman road, it seems more probable that their roofs were removed previously; and the appearance of the rock, along with the absence of any evidence of late residence, agrees with the character of the animal remains in indicating that their occupancy by man had been brought to a close anterior to the times of history, and possibly in the great submergence which closed the second continental or antediluvian period. There is, in any case, no evidence of any later occupancy than that by the early people whose *débris* is enclosed in the stalagmite.

I may remark here that the knives in these caves are made of the flint found in the immediate vicinity, and that they differ in no respect from those of the later caves and rock shelters of this region, except in being a little broader and more massive (Fig. 10).

On the border ot St. George's Bay, between the caves and Ant Elias, I observed, near the shore, and at no great elevation, a band of red loam and stones in which were a few similar flint flakes. The red earth in question is a *remanié* deposit derived from an older red earth of Pleistocene date,[1] and which contains no stones or flints. The flakes contained in this *remanié* earth may have been washed out of old caverns, or from the surface of the ground at higher levels; but probably at a period historically very ancient.

[1] See Chap. VIII.

The breccia of these caves is a somewhat hard and obdurate material, from which it is difficult to extract the remains which it contains; and the bones, and sometimes the flint knives, break across more

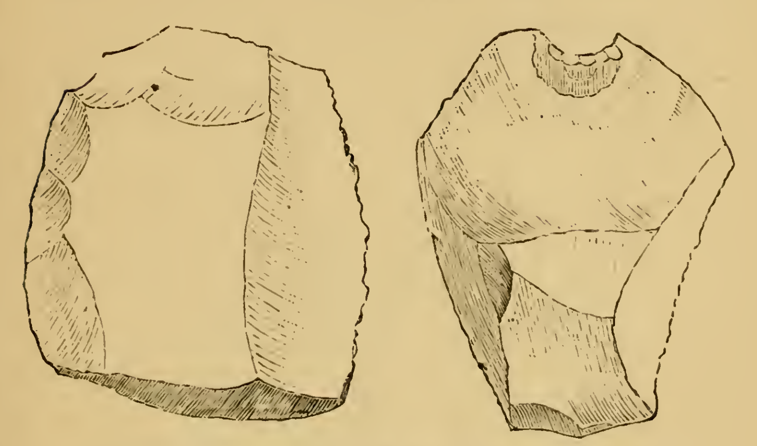


Fig. 10.—Flint Scraper and fragment of Knife (Nahr-el-Kelb).

easily than the matrix. We obtained teeth which Professor Boyd Dawkins assures me are those of *Rhinoceros tichorhinus*, the so-called woolly or hairy rhinoceros, and teeth of a species of deer, and of a wild ox.[1] We saw no shells or remains of marine

[1] The species recorded by Tristram, Lartet, and others, as found in the more ancient breccia of the Nahr-el-Kelb Pass are, in addition to *Rhinoceros tichorhinus*, the aurochs (*Bos primigenius*), the bison (*Bos priscus*), the reindeer (*Cervus tarandus*), and the fallow-deer (*Cervus dama*). Of these, teeth referable to the rhinoceros, aurochs, and fallow-deer are in my own collection; the others I have not seen. So far as I observed, the teeth of the rhinoceros are the most abundant.

animals; and the bones, which had all been broken, probably to extract their marrow, seemed to indicate, by their large sizes, that the cave men had subsisted principally on the rhinoceros and the wild ox. It was also observable that all the bones were those of the head and limbs, indicating that the hunters had dismembered their game where it was killed, and had carried the best pieces to their cave.



FIG. 11.—Dart or pointed Knife (Nahr-el-Kelb).—(*a*) section.

The flint knives are of the usual form, flat on one side, and with two or three faces on the other. They are sometimes pointed, and in that case may have been used as daggers or spears. A few specimens have rounded or hollow ends, chipped to serve as scrapers (Figs. 10, 11). There are also remains of

cores, and many small chips, showing that the implements were made on the spot. A fragment of a stone hammer of diorite was also found, very much decayed, through decomposition of its felspar, and it is observable that some of the flint flakes are quite white and opaque, while others are perfectly fresh. This may depend on the quality of the stone, or the degree of exposure to which it has been subjected.

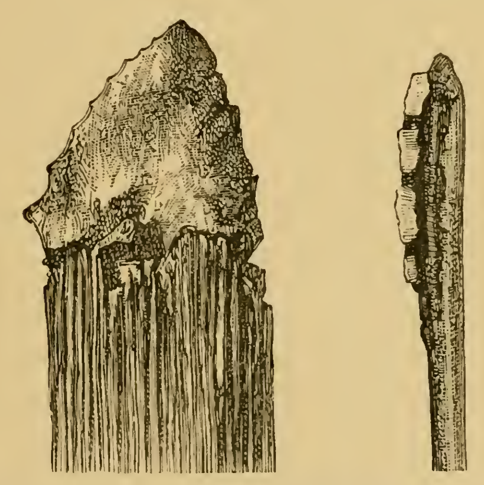


Fig. 12.—Rude Flints handled in wood (after Putnam). The larger from California; the smaller (⅓ nat. size) from Tasmania.

As an illustration of the manner of using the ruder forms of flints I figure, after Putnam, two specimens handled in wood (Fig. 12). They are modern and from California and Tasmania. Most of the bones in the breccia at Nahr-el-Kelb are white, and

destitute of organic matter; only a few small pieces are blackened, as if by the action of fire. No charcoal or remains of hearths were observed.

It will be observed that the great antiquity of these deposits does not depend on the mere hardness or amount of the containing stalagmite. This material is hard when first deposited, and, as Dawkins has shown in the case of the Ingleborough cave, may, in favourable circumstances, be deposited quite rapidly. The evidence of antiquity depends on the character of the animal remains and of the implements, and on the geographical inferences deducible from these. The implements are of a somewhat different style from those of Ant Elias and other deposits of that age. They are larger, bolder, and of more massive character, as if the work of a stronger and ruder race. Then the bones are not those of the modern animals. They are largely those of a species of rhinoceros now extinct, which inhabited Europe and Western Asia in the Post-glacial period. This is the hairy, or woolly rhinoceros,[1] so called from a specimen found in the frozen soil of Siberia, and showing that this species, unlike its modern representatives, was clothed with hair, fitting it for a cold climate. This animal makes its first appearance in Europe in the Pleistocene age, and became extinct before the historic period, along with the mammoth and several other animals, the cause of whose disappearance we shall have to consider in

[1] Rhinoceros tichorhinus.

the sequel. Now, at the time when the woolly rhinoceros lived in the Mediterranean basin, it was in the condition of continental elevation and division into two basins, referred to in the last chapter (Fig. 1). At that time, consequently, the caves of Nahr-el-Kelb were not on the edge of the sea, but looked out on a broad wooded plain, through which the Nahr-el-Kelb and other Lebanon rivers ran sluggishly westward, and probably coalesced into larger streams. Our cave-dwellers, therefore, lived near the river valley, but remote from the sea, and could hunt the rhinoceros over a wide and fertile plain, suited to that animal, extending, perhaps, as far as Cyprus, but now submerged. A species of deer and a bovine animal were also among those which they used as food, and probably other creatures as yet unrecognised in the fragmentary material they have left. The plains which supported the woolly rhinoceros were no doubt inhabited by many other quadrupeds, some of them living, others now extinct; but the hunters of the Nahr-el-Kelb caves may have preferred the rhinoceros, or may have found it more abundant or more easily killed than other animals, just as in the western plains of America the bison was the prevalent food, or as, farther north, the reindeer or cariboo is the principal animal hunted.

The facts above referred to are not confined to the Lebanon. I have merely selected the Nahr-el-Kelb caves because they occur in a region in which human history extends very far back. All over

Southern and Western Europe are found similar deposits in caves and river gravels. In the Cresswell caves, for example, explored by Dawkins and Millo, flint implements are associated with teeth and bones of *Rhinoceros tichorhinus*, and with those of the hare, bison, and deer. I may add that at Tyre old Phenician tombs are said to have been excavated in breccia, with flint knives similar to that of Nahr-el-Kelb, and that in many other places in Syria remains probably of prehistoric man have been found, though often in circumstances which render their date uncertain. In all these localities there is evidence of man in the same state of barbarism, and existing under geographical conditions different in some degree from those prevailing at present, and earlier than the earliest post-diluvian colonization of the country. In the case of our Nahr-el-Kelb caves we have the proof that man existed in the Lebanon at an earlier period than the Phenicians or the Flint folk who immediately preceded them, and under a different condition of the country; and as the Phenician colonization occurred not very long after the biblical deluge, these more ancient men must at least have been antediluvian, and the antediluvian period in their case must have coincided with that more elevated condition of the continents to which I have already referred. In other words, the men of the mammoth age, the palæocosmic men, or men of the Palanthropic age were antediluvians.

Unfortunately I have been able to obtain no skulls

or bones of the Lebanon antediluvians; but we may safely infer that they resembled those found in deposits of similar age in Europe. We may also infer that they were bold and skilful hunters, clothed in dresses of skin, knowing the use of fire and probably the art of carving in bone, the art of sewing garments, and other primitive arts; but otherwise rude and barbarous. These palæocosmic men bring geological and archæological science into direct contact with the lands of the Bible; and that we may understand the significance of this contact, it will be necessary to glance at what is known of the men of caves and river gravels elsewhere.

The question here naturally occurs—Is there any definite separation between the Palanthropic and Neanthropic ages corresponding to a diluvial cataclysm? This subject has been discussed by Dupont, Quatrefages, Dawkins, and others, and the evidence has recently been summed up by Howorth in his work, "The Mammoth and the Flood." Without anticipating here facts to be noted in the sequel, I may say—(1) That there is evidence that great physical and geographical changes occurred at the close of the Palanthropic age; (2) That these were accompanied by the disappearance of many of the larger and more important species, included in the animal population of the older period; (3) That in many parts of the northern hemisphere an earthy deposit of great extent and of considerable thickness intervenes between the deposits of the Palanthropic and

Neanthropic ages; (4) That the cases in which these seem to pass into each other are usually explicable by local accidents.

Very different opinions have been held by geologists and archæologists respecting the nature of the transition from the Palæocosmic to the Neocosmic age, whether abrupt or gradual. The great mass of evidence accumulated by Howorth[1] tells very strongly in favour of the former view; and he has shown that a preponderating amount of testimony of those best informed as to the details, tends in this direction, though the strong prejudice in favour of an excessive application of the law of uniformity has held back geologists from its candid acceptance. On the whole, the thoroughness of the change, as evidenced by the disappearance of many animal forms, and by great changes of physical geography and climate, as well as, in some regions at least, the replacement of one race of men by another differing in physique, and to some extent in arts and customs, cannot be denied. It may further be affirmed that the great submergence by which these changes were effected was locally so sudden, that it took full effect within the lifetime of one generation of animals. This is the necessary deduction from the entombment of so great quantities of mammalian remains of all ages in Siberia and elsewhere, as the last traces of the greater pleistocene species.

It is, however, to be observed that, as in other

[1] "The Mammoth and the Flood."

instances of change and extinction of species, the circumstances would be locally different. Wherever men or animals survived the catastrophe, there would be no absolute break between the ante- and post-diluvian times. Wherever all were destroyed, and especially where some interval of time elapsed before the population was renewed, the evidences of change would be more striking. Further, in places where the denuding agency of water had removed the old surface, or where, on the other hand, the local circumstances led to great deposition of sediment, with or without animal remains, there would be greater evidence of physical change than in places where the inundation was more quiet. Such local differences may in part account for the discordant conclusions arrived at by observers of the phenomena.

One of the best opportunities to obtain in an easy manner an acquaintance with the earliest known races of men, is to be had by a visit to the old *château* of St. Germain, one hour by rail from the modern city of Paris, contrasting perhaps as strongly as any place in the world with the old prehistoric times, yet influenced by inheritance from them more than itself knows. This ancient royal residence, which, among other uses, has served as a place of abode for our exiled Stuart kings, has been converted into a museum of prehistoric and antiquarian objects, illustrating more particularly the antiquities of France from the Roman period back

to the earliest known races of men, whose remains in some districts of France are specially abundant. The prehistoric collections include those of Boucher de Perthes, Lartet, and many other well-known French archæologists, and are arranged to illustrate the several types of primitive art distinguished by Professor Mortillet, and supposed by him to indicate distinct and successive periods.

The objects regarded as the oldest are those of the so-called "Achulian type," first discovered by M. de Perthes in the gravel of the Somme valley, near Amiens. The pits at this place, which I visited several years ago, are in beds of river gravel, but at such an elevation as to show that the river, when in flood, extended to a height of 150 feet above the present level. They belong to that pluvial or rainy period which succeeded the glacial age, and connected it with the modern time, when the *débris* deposited by the ice age had not yet been fully swept out of the river channel, and when the climate was colder than at present, as evidenced by heavy ice-borne stones imbedded in the gravel. Let us mark this time as a geological date, for it is near to the beginning of that same antediluvian age which we have indicated as the time of our early Lebanon men.

The most characteristic implements of this age are those which antiquaries now call by the appropriate French word "haches," an ancient onomatopoetic word common to most languages, and very

likely radically the same with that which the palæocosmic men themselves used. These *haches* are fragments of flint from the nodules found in the chalk and chalk gravels, which have been roughly trimmed into oval, or flattened ovoid, or pointed forms by blows on their edges. In some cases such a *hache* may have been merely a roughly hewn block to be afterwards trimmed into a more perfect instrument; but in its ordinary form it was a most useful tool or weapon. Held in the hand it could be used as an axe or a dagger; handled in wood or bone, or, as in some specimens of later date in this museum, fitted first into a bone socket, and this into a wooden handle, it was a battle-axe, a hatchet, or a hoe, as necessity might require. In the Cambridge Museum there is a skull of a fossil ox, with one of these *haches* deeply sunk into the bone, doubtless in deadly combat between the furious wild bull and some mighty hunter of the olden time. The best material for implements of this kind is flint; but in districts where flint does not occur, they have been made of quartzite and other hard stones, and of the harder slates. The *hache* is world-wide in its use, and to this day flints of similar form are used to arm the rude threshing implements and graters used in some countries.[1]

With the *haches* are found flint flakes represent-

[1] Mason describes a modern threshing sledge from Tunis and a modern grater from Honduras as so armed.—*Science*, Dec. 10, 1886.

ing another palæocosmic implement. The flake is a narrow splinter of flint, flat on one side, and angular or with three faces on the other, and sharp at the edges, sometimes square at each end, sometimes coming to a point at one end. It is produced by breaking a large flint into a prismatic core or nucleus, and then detaching flakes from the angles of this core by sharp blows. The process is simple, and similar to that by which gun-flints and flints for strike-lights are still made, but it requires good material and dexterity to produce long, thin, sharp-edged flakes of the best quality. Such flakes, used in the hand or fitted into a handle, are most efficient instruments for skinning animals and cutting up their flesh, and by working teeth on one or both edges, they may be used as saws. The pointed ones fitted into the end of a shaft are arrows, javelins, or spears. Quatrefages figures a human vertebra from a prehistoric interment, in which one of these flakes is firmly fixed on the inner side, having evidently been driven through the body of the man with a force almost equal to that of a rifle bullet. Such flakes have been used in every country from the earliest times. They have been made wherever flint occurs, and have been articles of trade to other districts. They were used in modern times by Mexican barbers to shave their customers, and by the Hebrews and Egyptians to perform surgical operations. They are to be found in all the sites of early human habitation in the East, and appear for

the latest time in the Bible in the circumcision of the children of Israel after crossing the Jordan under Joshua.[1]

Near to these Acheul remains in our museum are specimens from the districts of France where the chalk flints do not occur, and where the flint folk made their *haches*, with greater difficulty no doubt, but in the same form, of quartzite from the older rocks. Dawkins has ascertained a similar fact in the Cresswell caves in England, whose inhabitants at first used quartzite, but later, either by trade or extended exploration, obtained flint from the south of England. In the Cresswell cave and in the French caves of the Ardêche, the people who used these rude implements fed, like our Lebanon men, on the woolly rhinoceros and his contemporaries.

Next we have cases filled with flint implements from the caves of the Dordogne, supposed to be a little later in date. Here we have, along with the rude flint implements of the previous age, others worked by minute chipping on the edges into regular arrow heads, similar to those used in modern times by the American Indians. We have also implements, or handles of implements, of reindeer antler elaborately carved, sometimes with admirably designed figures of animals. These constitute what De Mortillet calls the "type Soloutrienne," and there is an intermediate type—"Moustierienne,"—which, however, differs but little, except in the coarser work

[1] Joshua v. 3.

of its arrow-heads. These arrow-heads evidence a new style of stone-chipping. The flake is broken off at a single blow, but if it is to be worked into an arrow head, it is subjected to an elaborate chipping of the edges, not by blows, but by pressure of a bone or metal implement, so as to detach minute flakelets from the edges, and thus gradually work it into shape. This is an art requiring skill and practice as well as patience. It has been practised by all the nations which have used spears and arrows of stone. A few examples of flakes, modified to be used as scrapers, show that it was known to the oldest men, but it was brought to perfection in France by the early men of Soloutre and the Dordogne.

Lastly, we have the type "Magdalenienne" of Mortillet, from the cavern of that name, in the collections from which we find mortars for grinding, flat stone hammers, beautiful bone harpoons, and neatly made bone needles. These implements are on a level with those of the modern Esquimaux and the agricultural village Indians of pre-Columbian America.

All these remains are believed to belong to the earliest prehistoric period of France; and since they refer to a time while the mammoth and tichorhine rhinoceros and their companions were still extant, they are properly antediluvian. They show only the more durable objects left by these people, and prove some progress in the arts of life. The needles, and the marks carved on the arms of some of the

figures executed in bone or ivory, would seem to indicate clothing and even embroidery. The numerous and well-made harpoons show the capture of large fish, and consequently the possession of canoes. Pieces of ivory, marked with lines at different distances, perhaps indicate gambling sticks like those of the modern Haidas of the west coast of America, or some attempts at numeration and records of events. The great station of Soloutre seems to have been a fortified village, whose inhabitants were buried in stone-walled graves; and the abundance of skeletons of horses has been supposed to indicate that this animal had been domesticated. Lastly, there would seem to be no doubt that the art of the potter was invented during this Palanthropic age. We shall find that all these arts were practised as far west as France before the great flood which so much reduced the habitable earth and its inhabitants.

The St. Germain Museum goes on to exhibit admirable series of remains of the ages of polished stone, of bronze and of iron, in France, but we must pause here for the present.

Mortillet has argued very forcibly in favour of a succession of periods of palæocosmic man in France, as indicated by a gradual progress in the arts; and his views are embodied in the arrangement of this museum. It must be admitted, however, that all belong to one fauna and one set of geographical conditions; and that, though in certain localities a gradual progress in art is indicated by the remains

in lower and upper beds, yet there is no evidence of distinct successive epochs. It is not improbable that the local differences observed may belong, not so much to successive time as to distinct tribes, differing somewhat in their arts. An interesting map of France, exhibited in one of the rooms, and showing the localities of the various finds, lends countenance to this view. The map seems to show a local grouping of the several types. There would seem to have been (1) a Pyrenean tribe along the slopes of the Pyrenees—a hill tribe, within whose district the celebrated station of Aurignac occurs; (2) a Rhine and Loire tribe, inhabiting the lower part of the former river, and part of the valley of the Loire; (3) a small sub-Alpine tribe near the Lake of Geneva, and especially at its southern end; (4) a Jura tribe from Soloutre, along the mountains to the head of the Somme; (5) a Seine and Somme tribe, extending from near Paris to the Atlantic; (6) a Meuse tribe, inhabiting the Meuse above Maestricht. These several patches of human habitation, separated by hills and forests, may have been occupied by tribes having little intercourse with each other; perhaps often hostile, and differing in the resources of their districts and their mode of using them. This is an interpretation of these French remains, based on what is observed in the case of American tribes in modern times.

We naturally look in such a museum for some remains of the men themselves, as well as their works.

Remains of this kind are fortunately not wanting in France and Belgium, and they indicate two races, or perhaps more properly varieties of one race, as contemporaneous or locally successive in France. These have been called respectively the "Canstadt," or Neanderthal race, and the "Cro-magnon," or Engis race.

The best-known examples of the first are the two human skeletons described by Fraipont and Lohest, from the floor of the Grotto of Spy, on the river Orneau, near Namur, Belgium.[1] They were found associated with flint implements, referred by the discoverers to the Mousterian type, as indicated above, and with a single splinter of bone shaped into a point. With these were abundant bones of *Rhinoceros tichorhinus*, and bones of the horse, stag, reindeer, fossil ox, mammoth, bear, badger, and hyena. Immediately above the skeletons was a layer in which, with similar stone implements, there occurred numerous well-made ornaments and implements in ivory, bone, and antler. That these belonged to the same or the immediately succeeding period, is shown by their association with the bones of the same animals found below, though they show a continued progress in art, or an increasing wealth and prosperity of the people inhabiting the cave. With respect to this last consideration, which is often overlooked, it is to be observed that a first

[1] L'Homme Contemporain du Mammouth, à Spy, Namur, 1887.

settlement of a rude people in a new locality is necessarily a time of poverty and comparative scarcity of utensils; and as the tribe establishes itself, and becomes more numerous and better acquainted with the resources within reach, or perhaps connected with other tribes by commerce, its resources and property increase. It is further to be noticed, that should a tribe be exterminated by accident, disease, or war, or obliged suddenly to emigrate, the last deposit left by it will necessarily be richer in objects of art than any previous one.

The men of the cave of Spy were of the Canstadt type. They constitute a peculiar race, not precisely similar to any modern one, though all of their peculiarities may be found in certain races, and in occasional individuals. The stature was short, or not tall, the body thick-set and muscular, with a somewhat bandy-legged gait, such as is seen in savages frequenting forests. The head is long but low, with projecting eyebrows and receding forehead, but with a somewhat large brain case, large orbits, high and wide cheek-bones, giving a broad face; jaws massive, the lower jaw receding abruptly, so as to produce a receding chin. These are not prepossessing characters for early European man; but they are entirely human and not simian, and exist to-day in certain tribes of American Indians, Negroes, and Australians, though in these with a less full development of brain. It is to be observed, however, that in some individuals the characters are less extreme, and pass into

those of the type next to be noticed—a fact observed in the skulls of some American tribes, and in individuals of higher races. It is said, for example, that Robert Bruce had a Canstadt skull, and so had St. Mansuy, Bishop of Toul, and a modern Danish statesman, Kai-Likké, according to Quatrefages.[1] The figure facing this chapter, which is reproduced from my work, "Fossil Men," will show the type of head referred to.

If one were to infer anything as to the qualities of the Canstadt or Neanderthal man, we should say that he was active, energetic, observant, cunning, not unlikely bold and adventurous, prompt to action rather than to thought, keenly observant, but rude, possibly cruel, and disposed to deeds of violence.

His contemporary, and locally his successor, the Engis, or Cro-magnon man, was of superior style—tall, powerfully built, with a less repulsive countenance and good forehead; his brain-case was larger than that of European men of to-day, and he was much on a par with the larger and better developed races of interior and Northern Asia and North America—a man fit to make his way in a world larger than the present, and full of great and formidable beasts. These men were probably better artists and more highly advanced in culture, though still, so far as known, rude and low in civilization. It is to be observed, howêver, that since we know that the lower and probably more fertile tracts of

[1] Quatrefages, "Homme fossile."

the antediluvian world are still under water, we may be ignorant of the most advanced of the men of the mammoth age.

A fine example of the skeleton of this race of men exists in the museum of the Jardin des Plantes, where I had the pleasure of examining it in 1883. This is the celebrated Mentone man found in a cave at that place, under at least eight feet of culinary *débris* and other accumulations, and associated with chipped flint implements, and bones of animals extinct as well as living. At one time doubts were thrown on the age of this skeleton, but a recent discovery of another interment in these caves, to be noticed immediately, removes these doubts. The bones of the Mentone man lie as they were found, imbedded in a hardened, almost stony mass of earthy *débris*, and are those of a tall, strong, well-formed man, with a remarkably well-developed head. Some shells of the pearly nerita of the Mediterranean attached to the skull, show that he wore a head-dress or helmet ornamented with these shells. A bone pin was placed in front of this head-dress, as if to support a plume or other ornament, which has perished. Around the edge of the cap were shell pendants ground into ovate shapes, and at the back are a few flint flakes, well formed and pointed, possibly the points of small arrows stuck in the hair. In front of the face is a little rectangular space, possibly the mark of a perished box or casket filled with specular iron ore, which lies around, and was,

no doubt, intended for war paint. The head and bones of the face remind one of those of our Iroquois or Huron Indians. The teeth are very perfect, but much worn, especially the incisors, indicating age and coarse food, or dried meat containing sand. The skeleton does not lie on a level surface, but somewhat inclined, with the head and shoulders higher than the feet, and in an easy and natural position, giving the impression that the man had lain down to rest when near death, and had passed away quietly without pain, and that his body had been left as it lay, and perhaps merely covered with earth, retained by a few stones at the sides, so as to conceal and protect it.

A second skeleton was discovered in one of the Mentone caverns in March, 1884, and is thus described by Mr. Thomas Wilson, in the Proceedings of the Anthropological Society, Oct. 1885 :—

"This cavern had been searched many times before, and about nine or ten feet in depth had been removed from the original surface, which, however, was plainly marked by a large piece of *brèche* which still adhered to the perpendicular side wall. The formation of the floor of the cavern and the process of its filling up presented all the usual evidences of human occupation and industry. Charcoal, burnt earth and ashes, hearthstones, split and broken bones of animals (estimated to the number of 15,000 pieces), flint instruments, chips, nuclei, etc., etc., were found in sufficient number, quantity, and distribution to

indicate an indefinitely long occupation. No morsel of pottery was found, nor were any of the stone implements polished. At the depth (from the original surface) of 8 mètres 40 centimètres was found the skeleton of this "new man of Mentone." He was laid on his back with his limbs extended, and had for funeral equipments three large chips of flint (*éclats de silex*), 6 or 7 inches long and 2½ inches broad, in the form of the largest scrapers, placed one on each shoulder, like epaulettes, and one on the brow. It was evidently an interment. This became more evident when it was found that the body was placed in a sort of natural vault or tomb, formed on one side by the wall of the cavern, and on the other by an immense block of stone with an overhanging edge, which reached to a line perpendicularly over the centre of the skeleton. This placing of the body required an excavation between these rocks of three or four feet in depth. Mr. Wilson maintained that the discovery of this skeleton dissipated all idea of disturbance, for while disturbance might exist for one or two, or even five or six feet, to the depth of twenty or thirty feet it would be impossible. He also maintained that the human industry, as manifested by the objects found in these caverns, indicated their occupation during the Palæolithic age, for of the thousands found, all bear the impress of that age, while none denote particularly the age of polished stone."

Next in interest to the Museum of St. Germain

is the Royal Museum in Brussels, where the great collections, principally from the caves of the valley of the Lesse are admirably arranged, though in a space too confined, considering their great interest and importance. The caverns in the picturesque limestone cliffs of the valley of the Lesse were apparently favourite places of resort to prehistoric men, and by Schmerling and his successors have been explored with great care. More especially the researches of Dupont in these deposits are worthy of much praise, as having been conducted in a most careful and scientific manner.

Dupont does not follow the over refinement of the French archæologists in his arrangement, but contents himself with a three-fold division of his prehistoric treasures. First, there are the remains of the "mammoth age," found with the bones of that and other extinct creatures. Secondly, we have the *débris* of the "reindeer age," in which that species becomes prominent or dominant, instead of its gigantic predecessors. Lastly, there is the age of polished stone, gradually passing into those of bronze and iron. In accordance with this order the specimens are placed in the cases, and large diagrams exposed on the walls show the arrangments and sequence of the deposits in which they were found.

The mammoth age of Dupont corresponds to the older Lebanon caves, and to the older cavern deposits of France and England; and the men of that age were the Canstadt and Cro-magnon men—pa-

læocosmic or antediluvian men. In their time Belgium was a densely wooded country, inhabited by the mammoth and the hairy rhinoceros; and what is now the bed of the German Ocean was a great plain, over which the herds of these animals could migrate freely from north to south. At this time also the streams of the limestone districts had not cut their channels so deeply as at present, and they were much larger, especially in times of flood, so that caverns in the cliffs, now ninety feet above the river, were in times of great occasional floods inundated, and their floors covered with mud. This circumstance has preserved the sequence of deposits, since in some of these caves there are as many as six layers of inundation-mud covering successive layers of *débris*.

The remains of the reindeer age lie above those of the mammoth age, and in the style of their implements correspond rather with the newer Lebanon caves, and the later bone caves of France. The human bones associated with these deposits represent a small short-headed race, resembling the modern Lapps, and distinct from that of the mammoth age in Belgium. In their time the mammoth and its companions had disappeared locally, and the climate may have been colder, while the animals of Belgium seem to have resembled those at present found in it, except that the reindeer and some other species now more northern were abundant; but this may merely indicate a more wooded state of the country.

It is likely, however, that in this period the climate was severe, and the limits of the land had probably contracted to smaller dimensions. These men are usually relegated by archæologists to the later part of the Palæocosmic age. The deposits containing their remains are stated by Dupont to be overlaid by the superficial clay which corresponds to the clay of the plains, and which separates them from the Neolithic deposits. They constitute, according to him, a transition group, marking changed conditions and probably migrations of tribes from the North at the close of the Palanthropic or antediluvian age.[1]

The men who succeeded these and established the later stone and bronze ages, were the ancestors of the Iberians or Basques and other Turanian tribes which occupied Europe in post-diluvian times, and were the immediate predecessors of the Celts and other modern races. Their descendants yet locally survive, as in the Pyrenees, in Wales, and in the south of Ireland.

In our present inquiry we are chiefly concerned with the earlier palæocosmic men, and may notice what the Belgian collections tell us of them; bearing in mind that they were probably the contemporaries of the people of the Nahr-el-Kelb caves, and of the antediluvians of the Bible history.

[1] A remarkable skull from La Seille, in Southern France, now in the Lyons Museum, and said to belong to the mammoth age, resembles the later form of short-headed skull above referred to, though of somewhat higher type.

Perhaps the easiest way to understand these primitive men will be to follow Dupont in the exploration of some of the caverns, and we may select as specially instructive those of Goyet, situated on the Lesse, a little tributary of the river Meuse. These caverns are evidently portions of galleries excavated by subterranean waters, before the river had cut its present channel, and are of some extent and complexity. Their height above the present river is about fifteen mètres. In one of these caverns six distinct layers of fluvatile silt were observed, indicating as many inundations, all of these having apparently occurred in the mammoth age. The lowest bed seems to have afforded no remains. The next had skeletons of the cave lion and the cave bear. A specimen of the former was so perfect that it is now mounted in the museum. The next bed introduces traces of man, but in a peculiar relation. This bed is full of remains of hyenas and of bones of mammoth, rhinoceros, and other animals which have been gnawed by these carnivorous beasts. Among these are human bones, showing that one human body at least had been devoured by the hyenas. Thus these early remains indicate that the ave was at first a den of lions, bears, and hyenas, which may have inhabited the country before the advent of man, and which occupied the cave in the intervals of the river inundations. In the three remaining layers there is evidence that man himself occupied the cave, and left there quantities of bones

broken for extraction of the marrow, *débris* of cooking, and various implements and ornaments. As now arranged in the museum, these objects may be summarized as follows, and constitute an interesting inventory of the household goods of an antediluvian tribe or family, or of such of these as could resist decay.

First, we have bones of twenty-three species of mammals, broken to extract their brain and marrow, and including the mammoth, rhinoceros, wild horse, reindeer, and cave bear. It is further observable that the bones of the larger animals are only those of the head and limbs, showing that these ancient hunters dismembered their game when it was killed, and carried to their home only the choicer pieces. The head they valued for the brain, the tongue, and other rich morsels, and possibly also for the teeth; the limbs, for their flesh and marrow-bones. Like other savage hunters, they no doubt extracted also the heart and liver; but of these of course no trace remains. They were sufficiently strong and well-armed to slay the elephant, rhinoceros, lion, and bear, and could also capture the deer, chamois, wild goat, and fox—evidence that they could use darts, arrows, or lassos, or could contrive pitfalls and traps. They could even kill some species of birds. It may be noted here, that though the successive beds containing these remains may mark a considerable lapse of time, there is no evidence of any change in the physical condition of the country, or its animal

population. Here, as in the Lebanon, there is no indication of the use of fish or shell-fish; but the sea was far away, and the river fish were perhaps no more to the taste of these people than to that of the buffalo-hunters of the western prairies. It is also interesting to observe that the deposits of this cave show the co-existence, in this vicinity, of animals now so remote from each other as the lion and hyena and the reindeer; but it is to be borne in mind that the period was one of great continental plains, favouring migrations from north to south, like those of the bison and cariboo in the great plains of North America, and a period also of abundant forest shelter, and of a continental climate, warm and dry in summer, though cold in winter. As Dawkins has well maintained in the case of the English caves, and Howorth in that of the great deposits of this age in Siberia, these considerations explain the otherwise strange mixture of animals.[1] It is further of interest

[1] The movements of such animals as the bison, the reindeer, and the lemming, in modern times, show that some portion of the remarkable intermixture of forms of animal life, now restricted to different climates, may be accounted for by such migrations. On the other hand, as Howorth has well shown, the testimony of fossil plants and of land snails shows that the climatal conditions of the arctic and temperate regions were more uniform than at present, while the facilities for the dispersion of species over the land were much greater. Thus the palæocosmic or antediluvian world, though its climate was not so warm as in some previous periods, presented great facilities for the accommodation of an abundant and varied fauna and flora, and correspondingly great resources to those

that of the great animals known to have existed in Europe in the Palæocosmic age, the only one not represented in these deposits is the hippopotamus. It is not impossible that this powerful and amphibious animal, if within reach of the primitive Belgian hunters, may have been able to defy their assaults. At a much later period the Book of Job represents it as invincible by man; and the early Egyptians evidently regarded its chase as one of the greatest possible achievements.

The collection of bones of small animals heaped at one side of the cave, referred to by Dupont, would, according to American analogies, represent a time at which it was occupied by women and children alone, when the men were absent on some expedition, or had been destroyed in war, and when the occupants, without able-bodied hunters, were obliged to subsist on such small animals as they could ensnare.

rude tribes of men which at this time spread themselves so widely.

As many as 135 species of mammals have been catalogued as contemporaries in Europe and Northern Asia of the mammoth and of palæocosmic man. They include nearly all the species now inhabiting those countries, with some, like the mammoth, now extinct, and others locally extinct, that is, existing beyond the European territory. Of the latter, some, like the musk-ox, have retired to the extreme north, while others, like the hippopotamus and the hyena, have retreated southward. It is this great richness and variety of the palanthropic fauna that has seemed so puzzling to naturalists and geologists.

Secondly, the flint implements and weapons ot the cave of Goyet are similar to those already referred to as found in the earlier French caves. It is to be observed, however, that the Belgian peoples of this district must have obtained their flint by excursions or by trade, from the chalk districts at some distance from their homes. This material would therefore be valuable, and consequently native quartzite was used for the rougher kinds of implements. It is curious to note here that these antediluvian peoples were sometimes dependent on foreign countries for the knives used to cut the flesh for their daily meals, as well as for their most effective weapons. Thus far, at least, they were free-traders; but, as was natural, they used bone and ivory for as many purposes as possible. Their piercers, dart-points, needles, and sometimes elaborately carved skull-crackers of antler (called "*bâtons de commandement*" by the French antiquaries), were similar to those in universal use in primitive times in North America.

Thirdly, ornament was not neglected by this ancient people. To what extent they used feathers, colouring, or embroidery on their head-dresses and robes, we cannot know; but they made collars and necklaces of pierced canines of the wolf, the fox, and the deer, and of the incisors of the horse and ox; and these may, as in the case of the American Indians, have been at once ornaments and trophies of the chase. One collar or necklace in the Brussels

Museum is deserving of special notice. In some of the calcareous tertiary beds of Champagne, there are long spiral shells, *Turritellæ*, about an inch in length, replaced by a beautiful white and translucent agate or chalcedony, and it is curious that similar *Turritellæ*, preserved in the same way, occur in the cretaceous limestone of Palestine. One hundred and eighty of these beautiful shells have been collected and cleaned, and strung into a collar which any modern lady might regard as an elegant ornament. The only colouring matter found in these deposits is that universal one, red oxide of iron, which they may have used as war-paint, or to ornament their skin robes. Lastly, in this connection, there are phalanges of deer pierced so as to form a sharp-sounding whistle, which might be used as a call, or as a simple instrument of music. It is stated, I do not know whether on good grounds, that whistles of this kind have been found in French caves, which give four musical notes corresponding to the tetrachord of primitive European music.

Fourthly, and this is a most important note, Dupont records in caves of the mammoth age, charcoal and the ashes of fires, and fragments of rude earthen vessels. It has been confidently asserted that the palæocosmic men were ignorant of the potters' art, but this is now known to be an error. It is to be observed, however, that local circumstances might determine whether certain tribes would make pottery or use closely woven baskets, gourds, wooden

vessels, etc., for holding and cooking their food. Modern tribes which do not make pottery, can boil meat by placing it in water, and heating this with hot stones.

In the cave of Goyet there were no interments of human skeletons, but, as already stated, skulls of the Canstadt and Engis types are found in the Belgian caves of the same date, and associated with similar remains.

Before leaving this cave, it may be well to observe that, as it was occasionally inundated, it would scarcely be a safe or comfortable place of continuous residence. It may therefore have been only an occasional haunt of hunting parties, whose ordinary abodes may have been at some distance, and perhaps of very different character from caverns. This supposition also accords with the fact that so few indications of sepulture occur in connection with these earlier cave deposits, though sepulchral caves of the reindeer age are known. In these last, deposits of useful and ornamental articles were made with the dead, and this seems also to have been the case in the interments of the mammoth age, as for example, in those of Mentone. This gives us the one religious idea which we can collect from the remains of these primitive people, that of immortality and of the persistence in some way of the spirit of man beyond the grave. The whole of the known creed of palæocosmic man is that summed up by Lyell in his quotation of the lines,—

"Bring here the last gifts, and with these
The last lament be said;
Let all that pleased and yet may please
Be buried with the dead."

One remark of the Belgian geologists must be noticed here. The deposits of the mammoth age, and it would seem of the reindeer age as well, are covered with beds of yellow earth, brick earth, and earth with angular stones, which antedate the later stone age and bronze age. These deposits constitute the ordinary soil of the country, and at all levels, and they are evidently of the same nature with the superficial gravels, soils, and loess to be found resting on the pleistocene deposits everywhere in the northern hemisphere, and which have poured into all the old caverns of the Palæocosmic age. They are not to be confounded with the ordinary glacial deposits which in northern districts underlie them. They are not river deposits, because no possible extension of the river beds could overflow the places where they lie, or bring the stones from very distant localities which the gravels often contain. They prove, as Howorth, the Duke of Argyll, and the writer have argued, that at the close of the Palæocosmic age a deluge of water swept over our continents and caused the physical break between the earlier and later human ages. This great cataclysm was preceded in Europe at least by a gradual refrigeration and a progressive extinction of the larger animals, and was followed by a diminished

size of the continents, and by the advent over the depopulated surface of a more limited fauna and a new race of men. That it must have been this great cataclysm which has fixed itself in the traditions of all races of men as the historical deluge, we can scarcely doubt.

To complete our review of palæocosmic man in Europe, I may mention the interesting collection of Abbé Daoust from Soloutre, now in the Museum of Lyons, and which the director kindly permitted me to examine with care. Soloutre is a station in the east of France, where a large tribe of the Palæocosmic age seems to have lived, and which gives an illustration of a village community of that age, as distinguished from a mere cavern shelter or river-side station. The Soloutre station, though founded and primarily occupied by antediluvian man, has been tenanted by later men down to the present time. I shall refer only to the objects apparently of most ancient date. The older skulls of Soloutre are of the Cro-magnon type—the sockets of the eyes perhaps not so long as in the more typical skulls of the race. The horse, whose remains are found so abundantly here, is a large-headed and short-limbed variety. The abundance of remains of this animal, and the fact that entire skeletons are found, has been variously explained. Some have supposed that the Soloutrians had tame horses; others,—and I believe Abbé Daoust is of this opinion,—that they took advantage of a crag in the vicinity to form a corral, by

means of which herds of wild horses were driven over the crag and destroyed. The bones of the reindeer are very numerous also, and there are teeth and tusks of the mammoth. The flint implements are very varied. Some are as rude as those of St. Acheul. Others are finely worked into lances six inches long. There are also flint arrow-heads, but these are supposed to be superficial, as are certain rounded stone hammers and rudely polished axes. There are many well-made bone piercers and spears, also bone handles with the figure of the reindeer carved on them, teeth of cave bear, shells of *Purpura*, *Cerithium*, and *Cardium*, and flat stones perforated for suspension.

These Soloutrian remains, though they show the difficulty in such circumstances of separating modern from more ancient remains, are of special interest in many respects. If the Soloutrians entrapped horses by fences or corrals, they probably preserved the flesh as dried meat or pemmican for future use, a habit which would also serve to account for the great quantities of broken bones of the reindeer found in some French caves, and for the numerous bone needles, which may have been used in stringing strips of meat to dry, or in making pemmican bags of the skin. If they had actually tamed the horse, they could use this in hunting other animals, and might also, like the Kirghis of Northern Asia, slaughter horses for food.

The special value of the Soloutre station is, that it

shows that the palæocosmic men were not all cave-dwellers, but that they had also villages; and it may well be that the Soloutre station does not give an adequate idea of their better "cities" or fortified towns.

I have dwelt at some length on geological and archæological collections representing the antediluvian age, as introductory to any correct appreciation of the biblical account of it, and its relation to Bible lands. Similar illustrations could have been obtained from the great British collections, like those of the British Museum and the Universities, and from the remarkable private collection accumulated by that accomplished student of the ages of stone, Dr. John Evans, at his residence at Hemel-Hempstead, and which I had the pleasure of examining under his guidance. In this collection also, as well as in the great collections of the National Museum at Washington, there are perhaps the best opportunities of studying the similarity of the stone and bone implements of all countries and periods—similarities with minute yet well-marked differences, which Evans has perhaps done more than any other person to define and illustrate.

It now becomes necessary to make some excursions into the domains of biology and geology, in order to familiarize ourselves with the conclusions or speculations as to the origin and date of primitive man which have been based on such facts as those above stated, and which may serve to aid us in

connecting them with Bible lands and Bible chronology.

It may have been expected that the cave-hunting and other researches noticed in the previous pages would have thrown some light on the absolute origin of man as a denizen of the earth; but the result in this respect is somewhat disappointing. In the bones and implements of the caves and gravels man appears before us as man, and tells us nothing as to how he first appeared upon the earth. The speculations as to the derivation of man from lower animals often obtruded by popular writers on a too credulous public, and sometimes even confidently stated as if established results of science, have as yet no basis in archæology or geology, since no transitional form between man and beast has been discovered. Even Haeckel, the great German apostle of the evolution of man, has to admit in his imaginary table of derivation two missing links still unknown to science. That man, with his physical peculiarities and high spiritual endowments, could have originated spontaneously or accidentally from any inferior animal known to us, is simply incredible. As to the manner in which it pleased the Divine Maker to produce the bodily frame of the first man, we have as yet no information further than the fact that the human organism is in a general way on the same plan with that of the higher animals, and the materials thereof the same dust of the earth of which they are made. It is well for

scientific inquiry to look for intermediate links between man and lower animals; but they must be discovered before we can discuss their relations, or the question whether they were suddenly or gradually produced.

The usual basis for a biological belief in the evolution of man is well stated by my late lamented friend, Dr. Carpenter, in his article on the doctrine of evolution in the *Modern Review* (Oct., 1882):—"Every human infant born into the world began its existence some months previously in the condition of a jelly-speck, not to be distinguished by any recognisable characters from what we may suppose to have been the germ of the animal-world in general." This germ goes on to a stage resembling that of a protozoon, then to a "gastrula" stage, in which it may be said to resemble a zoophyte. Then it passes through stages not differing "in any essential particular from the structure of a fish, a frog, a bird, and an ordinary mammal," and so finally it passes on to be a human infant. Now, by analogy, it may be imagined that a similar change has been going on throughout geological time, whereby lower animals have been progressively promoted to higher stages, till man was produced. It would, of course, be unreasonable to affirm that it is impossible for Almighty Power in this way to introduce the human species. But, on the other hand, it is unreasonable to affirm that the development of the individual from a previous similar

parent, under appropriate conditions and with appropriate nourishment, affords any proof that similar changes can take place where none of these necessary conditions are present. Such an analogy proves absolutely nothing, except possibly a general similarity in order between two lines of development altogether distinct, namely, that of the individual animal in its own life-time, and that of the species in geological time. When used as a substitute for such proof, it becomes mere jugglery and imposture. One might as well say, "Here is a hen's egg, in which the chick has attained to a stage corresponding to that of a fish, and here is an adult fish, and we must believe that, time being given, the latter as well as the former may pass through the remaining stages and become a chicken." Such a proposition would be rejected at once with ridicule, yet this is precisely the mental process required of us by some evolutionists, and for rejecting which we are stigmatized as stupid. Such false analysis of course becomes still more monstrous when presented by agnostics and monists who regard nature as spontaneous and uncaused, its laws as having no lawgiver, and its energies no guiding will. The history of the development of individual animals has long been known as a wonderful evidence of the homology or unity of plan which pervades nature, and as constituting man the archetype of the animal kingdom—the highest realization of a plan previously sketched by the Creator in many ruder and humbler forms.

It also teaches that it is not so much in the mere bodily organism that we are to look for the distinguishing characters of humanity as in the higher rational and moral nature.

The actual proof that a basis exists in nature for the doctrine of evolution founded on these analogies, might be three-fold. First, there might be changes of the nature of phylogenesis going on under our own observation, and even a very few of these would be sufficient to give some show of probability. Elaborate attempts have been made to prove that variations as existing in the more variable of our domesticated species lead in the direction of such changes; but the result in the actual production of a new species has never been attained. Secondly, there might be in the existing system of nature such a close connection or continuous chain of species as might at least strengthen the argument from analogy; and undoubtedly there are many groups of closely allied species, or of races confounded with true specific types, which it might be not unreasonable to suppose of common origin. These are, however, scattered widely apart; and the contrary fact of extensive gaps in the series is so frequent, that we are constantly under the necessity of supposing that multitudes of species, and even of larger groups, have perished, just where it is most important to our conclusion that they should have remained. This is of course unfortunate for the theory, but then we are told that "we must suppose" that the

missing links once existed. But thirdly, these gaps which now unhappily exist may be filled up by fossil animals; and if in the successive geological periods we could trace the actual phylogeny of even a few groups of living creatures, we might have the demonstration desired. Here again the gaps are so frequent and serious that even Haeckel, in his work on the Evolution of Man, scarcely attempts to use this argument further than by giving, in the beginning of his second volume, a short and somewhat imperfect summary of the geological succession. In this he attempts to give a series of the ancestors of man as developed in geological time; but of twenty-one groups which he arranges in order from the Laurentian to the modern period, at least ten are not known at all as fossils, and others do not belong, so far as known, to the ages to which he assigns them. This necessity of manufacturing facts does not speak well for the testimony of geology to the supposed phylogeny of man.

In point of fact it cannot be disguised that, though it is possible to pick out some series of animal forms, like the horses and camels referred to by some palæontologists, which simulate a genetic order, the general testimony of palæontology is on the whole adverse to the ordinary theories of evolution, whether applied to the vegetable or to the animal kingdom. This the writer has elsewhere endeavoured to show; but he may refer here to the labours of Barrande, perhaps unrivalled in extent and accuracy, which

show that in the leading forms of life in the older geological formations the succession is not such as to correspond with any of the received theories of derivation.[1] Even evolutionists, when sufficiently candid, admit their case not proven by geological evidence. Gaudry, one of the best authorities on the tertiary mammalia, admits the impossibility of suggesting any possible derivation for some of the leading groups, and Saporta, Mivart, Parker, and Le Conte fall back on periods of rapid or paroxysmal evolution, or of "metamorphosis" as it has been called, scarcely differing from the idea of creation under law, or mediate creation.

Thus the utmost value which can be attached to argument from analogy would be, that it suggests a possibility that the processes which we see carried on in the evolution of the individual may, in the laws which regulate them, be connected in some way, more or less close, with those creative processes which, on the wider field of geological time, have been concerned in the production of the multitudinous forms of animal life. But this philosophy goes but a very little way toward any understanding of such relations, and in so far as man is concerned, we have absolutely no means of affiliating him with any lower ancestry. On the other hand, the earliest known men are not specifically distinct from their

[1] Those who wish to understand the real bearings of paleontology on evolution should study Barrande's "Memoirs on the Silurian Trilobites, Cephalopods, and Brachiopods."

modern successors, so that there is no need to assume any diversity of origin for the races of men.

In so far, therefore, as biological analogy is concerned, and as it is presented to us by its ablest advocates, we have no further light than that given in the statement of Genesis, that man is made of the dust of the ground as to his bodily frame, but possesses an in-breathing of the Almighty in his spiritual nature; and that wherever and however he came into existence, we have as yet no clue to the nature of the process. We may turn now to the light afforded by geology.

No one in the English-speaking world has done more to elucidate the history of primitive man in Europe, than my friend, Professor Boyd Dawkins, of Manchester, whose rich collections in the Museum of Owen's College admirably illustrate his success as a "cave-hunter," in bringing to light the remains of other and more primitive cave-hunters. In one of his recent books, "Early Man in Britain," he gives an excellent summary of the facts relating to the geological position of the earliest men; and though I must differ from him somewhat in the classification of the deposits which he describes, his arrangement of the facts may be taken as the best guide in this discussion.

The Tertiary or Kainozoic period, the last of the four great "times" into which the earth's geological history is usually divided, and that to which man and the mammalia belong, was ingeniously sub-

divided by Lyell, on the ground of percentages of marine shells and other invertebrates of the sea. According to this method, which with some modification in details is still accepted, the *Eocene*, or dawn of the recent, includes those formations in which the percentage of modern species of marine animals does not exceed $3\frac{1}{2}$, all the other species found being extinct. The *Miocene* (less recent) includes formations in which the percentage of living species does not exceed 35, and the *Pliocene* (more recent) contains formations having more than 35 per cent. of recent species. To these three may be added the *Pleistocene*, in which the great majority of the species are recent, and the *Modern*, in which all may be said to be living. Dawkins and Gaudry give us a division substantially the same with Lyell's, except that they prefer to take the evidence of the higher animals instead of the marine shells. The Eocene thus includes those formations in which there are remains of mammals or ordinary land quadrupeds, but none of these belong to recent species or genera, though they may be included in the same families and orders with the recent mammals. This is a most important fact, as we shall see, and the only exception to it is, that Gaudry and others hold that a few living genera, as those of the dog, civet, and marten, are actually found in the later Eocene. In the case of plants, Saporta shows that in Europe and the neighbouring regions modern genera of land plants occur before the Eocene, in the last great group of

the preceding period, and we have abundant American evidence of the same fact. As in the Mosaic narrative of creation, the higher plants precede by a long time the higher animals. The Miocene, on the same mammalian evidence, will include formations in which there are living genera of mammals, but no species which survive to the present time. The Pliocene and Pleistocene show living species, though in the former these are very few and exceptional, while in the latter they become the majority.

With regard to the geological antiquity of man, no geologist expects to find any human remains in beds older than the Tertiary, because in the older periods the conditions of the world do not seem to have been suitable to man, and because in these periods no animals nearly akin to man are known. On entering into the Eocene Tertiary we fail in like manner to find any human remains; and we do not expect to find any, because no living species and scarcely any living genera of mammals are known in the Eocene; nor do we find in it remains of any of the animals, as the anthropoid apes for instance, most nearly allied to man. In the Miocene the case is somewhat different. Here we have living genera at least, and we have large species of apes; but no remains of man have been discovered, if we except some splinters of flint found in beds of this age at Thenay in France, and which are too doubtful as to their source and origin to be accepted as evidence.

In the Pliocene, as Dawkins points out, though

the facies of the mammalian fauna of Europe becomes more modern, and a few modern species occur, the climate becomes colder, and in consequence the apes disappear, so that the chances of finding fossil men are lessened rather than increased, in so far as the temperate regions are concerned. In Italy, however, Cocchi[1] has described a skull, an implement, and a notched bone, supposed to have come from Pliocene beds. I had the pleasure of studying this skull in Florence, in the winter of 1883. It consists only of the upper part, or calvarium. It is of long shape, large, and thick-walled, with well-developed forehead. Neither it nor the implement found with it seem to be of ancient type, and probably its association with Pliocene remains may be due to a landslip. The same museum contains a fine collection of the Pliocene and Pleistocene mammals of the Val d' Arno, which show a wonderfully rich land fauna in Italy in these periods. Among them is another fragment of a skull from post-glacial beds in Ovieto. This is seemingly of the type of the oldest skulls of Belgium and France. As the writer has elsewhere pointed out,[2] similar and apparently fatal objections

[1] "Homme fossile dans l'Italie."

[2] The facts, or supposed facts, stated by Mr. Wallace in the *Nineteenth Century* (Nov., 1887), do not invalidate the above statements. In America, as I have shown in the Appendix to my work "Fossil Men," the evidence for Pliocene man disappears on investigation, and Wallace makes no allowance for the effects of the post-glacial submergence, which in America, as in Europe, is an important factor.

apply to the skull and implements alleged to have been found in Pliocene gravels in California. Dawkins informs us that in the Italian Pliocene beds supposed to hold the remains of man, of twenty-one mammalia whose bones occur, all are extinct species except possibly one, a hippopotamus. This of course renders very unlikely, in a geological point of view, the occurrence of human remains in these beds.

In the Pleistocene deposits of Europe,—and this applies also to America,—we for the first time find a predominance of recent species of land animals. Here, therefore, we may look with some hope for remains of man and his works; and here, according to Dawkins, in the later Pleistocene, they are actually found. When we speak, however, of Pleistocene man, there arise some questions as to the classification of the deposits, which it seems to the writer that most geologists have not answered in accordance with geological facts, and a misunderstanding as to which may lead to serious error. This will be best understood by presenting the arrangement adopted by Dawkins with a few explanatory notes, and then pointing out its defects. The following may be stated to be his classification of the later Tertiary:—

I. Pleistocene Period: the fourth epoch of the Tertiary, in which living species of mammals are more abundant than the extinct, and man appears. It may be divided into—

(*a*) *Early Pleistocene*, in which the European land was more elevated and extensive than at present (First Continental

Period of Lyell), and in which Europe was colonized by animals suitable to a temperate climate. No good evidence of the presence of man.

(*b*) *Mid Pleistocene.* In this period there was a great extension of cold climate and glaciers over Europe, and mammals of arctic species began to replace those previously existing. There was also a great subsidence of land, finally reducing Europe to a group of islands in a cold sea, often ice-laden. On the evidence of flint flakes supposed to be from beds of this age, and of certain caverns in Wales, it has been held that man had entered Europe thus early; but the fact is at least doubtful, there being much difference of opinion among those who have studied the facts, as to the validity of the evidence.

(*c*) *Late Pleistocene.* The land was again elevated, so that Great Britain and Ireland were united to each other and to the continent (Second Continental Period of Lyell). The ice and cold diminished. Modern land animals largely predominate, though there are several species now extinct. Undoubted evidences of man of the so-called "palæolithic race," "river-drift and cave men," "men of the mammoth and reindeer periods."

II. Prehistoric Period: in which domestic animals and cultivated fruits appear; the land of Europe shrinks to its present dimensions. Man abounds, and is similar to races still extant in Europe. Men of "Neolithic age," "Bronze age," "Prehistoric Iron age."

III. Historic Period: in which events are recorded in history.

I have given this classification fully, in order to point out in the first place certain serious defects in its latter portion, and in the second place, what it actually shows as to the appearance of man in Europe.

In point of logical arrangement, and especially of geological classification, the two last periods are decidedly objectionable. Even in Europe the his-

toric age of the South is altogether a different thing from that of the North, and to speak of the pre-historic period in Greece and in Britain or Norway, as indicating the same portion of time, is altogether illusory. Hence a large portion of the discussion of this subject has been well called "the overlap of history." Further, the mere accident of the presence or absence of historical documents cannot constitute a geological period comparable with such ages as the Pleistocene and Pliocene, and the assumption of such a criterion of time merely confuses our ideas. On the one hand, while the whole Tertiary or Kaino-zoic, up to the present day, is one great geological period, characterized by a continuous though gradu-ally changing fauna and series of physical conditions, and there is consequently no good basis for setting apart, as some geologists do, a Quarternary as distinct from the Tertiary period; on the other hand, there is a distinct physical break between the Pleistocene and the Modern in the great glacial age. This in its arctic climate and enormous submergence of the land, though it did not exterminate the fauna of the northern hemisphere, greatly reduced it, and at the close of this age many new forms came in. For this reason the division should be made, not where Daw-kins makes it, but at or about the end of his "Mid Pleistocene." The natural division would thus be:—

I. PLEISTOCENE, including—

(*a*) *Early Pleistocene*, or First Continental period. Land very extensive, moderate climate.

(*b*) *Later Pleistocene*, or glacial, including Dawkins' "Mid Pleistocene." In this there was a great prevalence of cold and glacial conditions, and a great submergence of the northern land.

II. MODERN, or Period of Man and Modern Mammals, including—

(*a*) *Post-glacial*, Palanthropic[1] or Second Continental Period, in which the land was again very extensive, and Palaeocosmic man was contemporary with some great mammals, as the mammoth, now extinct, and the area of land in the northern hemisphere was greater than at present. This represents the Late Pleistocene of Dawkins. It was terminated by a great and very general subsidence, accompanied by the disappearance of Palaeocosmic man and some large mammalia, and which may be identical with the historical deluge.

(*b*) *Recent*, or Neanthropic, when the continents attained their present levels, existing races of men colonized Europe, and living species of mammals. This includes both the Prehistoric and Historic periods.

On geological grounds the above should clearly be our arrangement, though of course there need be no objection to such other subdivisions as historians and antiquaries may find desirable for their purposes. On this classification *the earliest certain indications of the presence of man in Europe, Asia, or America, so far as yet known, belong to the Modern period alone.* That man may have existed previously no one need deny, but no one can positively affirm on any ground of actual fact; while it cannot be denied that the physical conditions of the glacial period were of such

[1] I have used the term Palanthropic for the period itself, and Palaeocosmic for the men of this oldest human period. The terms Neanthropic and Neocosmic will serve the same purpose for the later or more modern races.

a character as to render the existence of man, in the northern hemisphere at least, very unlikely.[1]

Inasmuch, however, as the human remains of the post-glacial epoch are those of fully-developed men of high type, it may be said, and has often been said, that man in some lower stage of development *must* have existed at a far earlier period. That is, he must, if certain theories as to his evolution from lower animals are to be sustained. This, however, is not a mode of reasoning in accordance with the methods of science. When facts fail to sustain certain theories we are usually in the habit of saying, "So much the worse for the theories," not "So much the worse for the facts," or at least we claim the right to hold our judgment in suspense till some confirmatory facts are forthcoming.

Before leaving this part of the subject, it may be well to remark the grand procession of mammalian life, beginning with the marsupial and semi-marsupial beasts of prey and low-browed and small-brained but gigantic ungulates of the Eocene, and ending with man. There is here unquestionable elevation in rank, by whatever means effected. Gaudry inclines to some form of evolution, though he piously

[1] I have carefully considered the facts adduced by Dr. Hicks respecting the pre-glacial or inter-glacial appearance of man in Wales, but I cannot help suspecting that the supposed glacial deposits of the Ffynnon Bemw and Cae Gwyn caves may be *remanié* material, and the implements and other remains post-glacial.

refers it to the operation of the Creator. He thinks he can see traces of such evolution in the carnivorous animals, as derived from marsupials, and in the antelope and deer tribe, more especially in the development of horn and antler; and he traces the horse through a supposed ancestry of hipparia, etc., differing, however, from English and American evolutionists in making the *Paleotherium* the initial link. This is, however, a matter of taste, as these genealogies may usually be traced with equal probability or improbability through any one of half a dozen lines. But in the case of some groups of animals, and these of the highest importance, he freely admits that derivation is at fault. The elephants and their allies, the deinotheres and mastodons, for example, appear all at once in the Miocene period and in many countries, and they only dwindle in magnitude and numbers as they approach the Modern. Gaudry frankly says: "D'où sont-ils venus, de quels quadrupèdes ont-ils été dérivés? Nous l'ignorons encore." The edentates, the rodents, the bats, the manatees are equally mysterious, and so are the cetaceans, those great mammalian monsters of the deep, which leap into existence in grand and highly-developed forms in the Eocene, and which surely should have left some trace of their previous development in the sea. "We have," says Gaudry, "questioned these strange and gigantic sovereigns of the Tertiary oceans as to their progenitors, but they leave us without reply;" and he goes

on to refer to several things in connection with their habitat, their reproduction, and their dentition or want of it, which make their sudden appearance still more inscrutable. It is refreshing to find a naturalist who, while honestly and even enthusiastically seeking to establish the derivation of animals, gives due prominence to the facts which, in the present state of knowledge, refuse to be explained by his theory. The reader may note here that the appearance of man fully developed in the Modern period is parallel with that of the elephantine animals in the Miocene and the whales in the Eocene, as well as with a vast multitude of other cases which meet the palæontologist in every direction.

The world of plants has a strangely different story to tell, though its general plan evidently harmonizes with the history of mammalian life. If we keep out of view the few species of small marsupials that exist in the Mesozoic period, mammalian life in all its grandeur comes into existence at a bound in the Eocene. But it had been preceded for at least one great geological period by a vegetation similar to that now living. It can scarcely be questioned that the vegetation of the older geological ages, however rank and abundant, was not well suited to sustain the higher herbivorous animals. Accordingly, no such animals are known in these periods. But in the cretaceous age we find in the lower beds of that series some forest trees of living

genera, and in the upper cretaceous, modern generic forms come in, both in Europe and America, in great force. We have magnolias, oaks, beeches, ivies, ginsengs, plane-trees, poplars, palms, and a host of familiar forms, and some of these so closely resembling existing species that it scarcely requires the eyes of an evolutionist to see in them the ancestors of our modern trees. Thus an ample and long-continued preparation was made, not only for the introduction of mammalian life, but even for giving to the landscape its existing features. It seems indeed strange that no precursors of the Eocene mammals have yet been found in connection with these plant remains of the newer Cretaceous. There is a gap here in animal life which we may expect at some time to be filled. There seems, however, notwithstanding the great changes in climate and physical geography, to have been much less change from the cretaceous onward in the plant world than in the world of higher animal life, so that we can figure series of leaves of plants of modern genera from the Eocene upward, showing so little modification that they may in some cases be regarded as scarcely more than varietal forms, while some of the species have undoubtedly survived without change through all the long ages extending from the beginning of the Kaïnozoic to the present day. Plant-life is in this analogous to the lower animal life of the sea, which presents the same unchanged characteristics in Eocene and Modern species.

To return to primitive man and the date of his appearance in Europe, an important question is raised by Dawkins in the attempt which he makes to discriminate between two races of men supposed to have existed successively in Europe in post-glacial times or in the Second Continental period. These he calls respectively "men of the river gravels" and "cave men." The idea of such distinction seems to have arisen in his mind from the fact that in certain caverns in England the lowest stratum containing human remains affords only rude implements, while an upper stratum appears to testify to improved manufacture of stone tools and weapons, both strata being of so-called Palæolithic age; that is, belonging to the time when certain mammalia, now extinct, survived. Such facts, however, would rather seem to testify to local improvement in the condition of certain tribes than to any change of race. Such local improvement would be very likely to occur wherever a new locality was taken possession of by a small and wandering tribe, which in process of time might increase in numbers and in wealth, as well as in means of intercourse with other tribes. A similar succession would occur when caves used at first as temporary places of rendezvous by savage tribes became afterward places of residence, or were acquired by conquest on the part of tribes a little advanced, in the manner in which such changes are constantly taking place in rude communities. Yet on this slender foundation is built an extensive

generalization as to a race of river-drift men, in a low and savage condition, replaced after the lapse of ages by a people somewhat more advanced in the arts, and specially addicted to a cavern life ; and this conclusion can be extended to Europe, Asia, and America, wherever rude flint implements exist in river gravels. It is admitted, however, that no physical break separates the two periods ; that the fauna remained the same ; that the skulls, so far as known, present no material differences, except that between the Canstadt and Cro-magnon types already referred to—types which were probably contemporaneous, and that between the latter and the reindeer men, that is, between two races, both of which were cave-dwellers ; and that even in works of art the distinction is invalidated by grave exceptions, which are intensified by the fact, which the writer has elsewhere illustrated, that in the case of the same people their residences in caves, etc., and their places of burial are likely to contain very different objects from those which they leave in river gravels. Perhaps one of the most curious examples of this is the cave of Duruthy in the western Pyrenees. On the floor of this cave lay a human skull, covered with fallen blocks of stone. With it were found forty canine teeth of the bear and three of the lion, perforated for suspension, and several of these teeth are skilfully engraved with figures of animals, one bearing the engraved figure of an embroidered glove. This necklace, no doubt just such a trophy of the

chase as would now be worn by a Red Indian hunter, though more elaborate, must have belonged to the owner of the skull, who would appear to have perished by a fall of rock, or to have had his body covered after death with stones. In the deposit near and under these remains were flint flakes. Above the skull were several feet of refuse, stones, and bones of the horse, reindeer, etc., and "palæolithic" flint implements; and above all were placed several skulls and skeletons with "beautifully chipped" flint implements. After the burial of these the cave seems to have been finally closed with large stones. French explorers of this cave refer the lower and upper skulls to the same race; and there is no conceivable reason why a man who possessed a necklace of beautifully carved teeth should not have belonged to a tribe which used well-made stone implements, or why the weapons buried with the dead should have been no better than the chips and flakes left by the same people in their rubbish-heaps.

Another point which Dawkins has admirably illustrated is the marked distinction between the old palæocosmic men of the gravels and caves and the smaller race with somewhat differently formed skulls which succeeded them in the Later Stone age, after the great subsidence which terminated the Second Continental period and inaugurated the Modern epoch. The latter race he identifies with the Basques and ancient Iberians, a non-Aryan or Turanian people who once possessed nearly the

whole of Europe, and included the rude Ugrians and Lapps of the North, the civilized Etruscans of the South, and the Iberians of the West, with allied tribes occupying the British Islands. This race, scattered and overthrown before the dawn of authentic history in Europe, by the Celts and other intrusive peoples, was unquestionably that which succeeded the now extinct palæocosmic races and constituted the men of the so-called "Neolithic period." It thus connects itself with the modern history of Europe, from which it is not separated by any great physical catastrophe like that dividing the older men of the mammoth age and the widely spread continents of the post-glacial period from our modern days. This identification of the Neolithic men with the Iberians, which the writer has also insisted on, Dawkins deserves credit for fully elucidating, and he might have carried it further to the identification of these same Iberians with the Berbers, the Guanches of the Canary Islands, and the Caribbean and other tribes of Eastern and Central America. On these hitherto dark subjects light is now rapidly breaking, and we may hope that much of the present obscurity will soon be cleared away.

Another curious point, illustrated by the recent rediscovery of the tin mines of Tuscany, is the connection of the Estrucans with the introduction of the bronze age into Central Europe. This, when viewed in relation to the probable ethnic affinities of the Etruscans with the Neolithic and Iberian

races, remarkably welds together the stone and bronze ages in Europe, and explains their intermixture and "overlap" in the earlier lake habitations of Switzerland and elsewhere.

We are also indebted to Dawkins for a suggestion as to the linguistic connection of the Neocosmic and Modern periods, which is deserving the attention of philologists. He quotes from Abbé Inchaurpé, the following Basque words:—

Aizcora	=	Axe	=	Stone lifted up or handled.
Aitzurra	=	Pick	=	Stone to tear asunder.
Aizttoa	=	Knife	=	Stone, little or small.
Aizturrac	=	Scissors	=	Little stones for tearing.

He remarks that all these words are derived from the word *aitza*, *atcha*, stone, though now applied to implements of metal, and they are probably identical with such modern words as hache, axe, adze, and even with the primitive word *hac*, which has come in various languages to mean things so different as a king and a cutting instrument.[1] The same thing occurs in many American languages, in which the word for stone, with appropriate additions, is applied to different kinds of tools. It is also curious that in some of the American languages the word for stone is almost identical with that in Basque; but this applies to some other Basque roots as well. Still it is not unlikely that the onomatopoetic sounds, *itz*, *aitz*, and the like, applied to stone and cutting

[1] See the Hakim of Deborah, Judges, chap. v.

instruments in many languages, in all cases arose from the sounds produced by sharpened stones in cutting and rending.

A still more important speculation arising from the facts recently developed as to prehistoric men, is the possible equivalency with the historic deluge of the great subsidence which closed the residence of palæocosmic men in Europe, as well as that of several of the large mammalia, an equivalency which I have in previous pages incidentally referred to. Lenormant and others have shown that the wide and ancient acceptance of the tradition of the deluge among all the great branches of the human family necessitates the belief that, independently of the biblical history, this great event must be accepted as an historical fact which very deeply impressed itself upon the minds of all the early nations. Now, if the deluge is to be accepted as historical, and if a similar break interrupts the geological history of man, separating extinct races from those which still survive, why may we not correlate the two? The misuse of the deluge in the early history of geology, in employing it to account for changes that took place long before the advent of man, certainly should not cause us to neglect its legitimate uses, when these arise in the progress of investigation. It is evident that if this correlation be accepted as probable, it must modify many views now held as to the antiquity of man. In that case, the modern gravels and earths, and loess, spread over plateaux and in

river valleys, far above the reach of the present floods, may be accounted for, not by the ordinary action of the existing streams, but by the abnormal action of currents of water diluvial in their character, and may thus be a true "diluvium," as it was called by the older geologists. Further, since the historical deluge cannot have been of long duration, the physical changes separating the deposits containing the remains of palæocosmic men from those of later date would in like manner be accounted for, not by slow processes of subsidence, elevation, and erosion, but by causes of more abrupt and cataclysmic character, which, on any natural system of geological dynamics, must be admitted as possible. This subject the writer has referred to in previous publications,[1] and he is glad to see that prominence has recently been given to it by so good a geologist as the Duke of Argyll, in an article in the *Contemporary Review*, and also in an address delivered before the Edinburgh Geological Society.

In the latter paper the evidence assigned is mainly the distribution of surface deposits later than the glacial age, such as the loess, or "inundation mud," as it has been called, which covers so much of Europe and Asia, and the superficial gravels. Respecting the former his Grace remarks: "On the continent of Europe, too, we know that a large part of its central area is occupied by a formation (the 'loess') which Lyell calls 'inundation mud,' and which he desig-

[1] "Origin of the World." "Fossil Men."

nates as the last and latest of all the great formations known to geology. The difficulty of accounting for it is proved by the number of theories which have been propounded. The shells in this formation are not fluviatile, nor are they lacustrine. On the other hand, they are not marine. They are terrestrial. They are land shells—the shells of damp woods or morasses—in short, of a land surface which has been covered with this 'inundation mud.' One possible explanation is obvious. The sea establishes its own forms of life where itself is established for any length of time. But if its invasion of any land area be not lasting, but temporary, it may well fail to carry its mere dead shells over that area, whilst its living fauna would not have had time to grow. But here again this notion of a submergence temporary and transitory must at all hazards be dismissed. And so the ice cap again comes into play. There are no banks within which to confine a great European lake, but in the ice sheet banks are always ready; and so it has been supposed, among other explanations, that enormous masses of ice, walking of their own sweet will about the world, came down from the North and dammed back the waters of the Rhine, or of some other greater river which then took its place, and thus formed a lake in which this vast sheet of inundation mud was deposited. I do not pretend to be able to solve all the difficulties of the problem connected with the great formation of the 'loess.' But I am sure that any theory is better

than this, and further, I am sure that many difficulties will be removed if we can but face the conclusion that there has been in very recent times, and over a large area of the northern hemisphere, a great depression and a great re-emergence of the land towards the close of the glacial epoch."

Respecting the gravels the following statements are made :—

"The marine gravels, with dead shells of existing species found high up on the Welsh mountains, and also found near the top of the midland watershed of England, render it all but certain that the whole of England has been under the sea, in times so recent that zoologically they belong to the epoch in which we now live. All the older gravels which pre-existed upon the surface so inundated must have been then widely broken up and redistributed: and new gravel beds must have been formed by the washing away of the finer materials from out of stony soils. Accordingly we find that the gravels which are called river gravels are very often full of foreign material—foreign, I mean, to the drainage basin of the rivers with which they are connected. And here let it be observed, that whilst the absence of such foreign materials would not disprove marine redistribution, the presence of them in any one case may be conclusive proof of a much wider marine submergence than any affecting only the spot on which they are found. The distance to which the sea might scatter pre-existing gravels, or the distance

to which it would carry its own dead shells, would depend entirely on the violence of currents or the gentleness of submersion. But if we find anywhere in gravels high above the lines of existing drainage, quantities of material which must have been brought from a great distance, we may be sure that the currents which brought them there have also run, although with less rapidity, over the lower areas where no such materials are found. I can testify by my own observation, that what are called the high level gravels connected with the valley of the Thames are full of lumps and pebbles of rock which do not belong to the drainage of the Thames valley, but must have come, at least, from the older gravels of the centre of England, if not directly from the Welsh mountains. Now, the palæolithic implements of man have been found constantly in gravels which cannot with any probability be assigned to existing rivers, and may, with tolerable certainty, be assigned to the same marine submergence which has piled heaps of gravel with dead shells on the top of Moel Trefyn, and on the hills above Macclesfield, and,—without shells,—upon the mountains of Perthshire."

But this whole subject has been discussed with the greatest fulness in a series of papers by Mr. H. H. Howorth in the *Geological Magazine*.[1] He first refers to the loess of Western Europe, and the similar deposits in Eastern Europe and Siberia, and

[1] Also "The Mammoth and the Flood," 1887.

in China. Indeed, this deposit may be said to lie, more or less, over all the countries of the northern hemisphere up to heights of 4,000 and 5,000 feet. It is a loamy deposit, unstratified, though often of great thickness, destitute of marine shells, but with land shells and bones of land animals, and newer than the deposits of the glacial period, being, in fact, the latest deposit next to the modern peats and river alluvia. It caps and rests upon even the river alluvia, when these are of the early post-glacial or Palanthropic age. In some places large angular stones are associated with it, as are also beds of rolled flints and far-transported gravel. My own observations lead me to believe that in all parts of our continents which I have visited, these superficial deposits more or less occur, overlying all others, independent of existing river valleys and lines of drainage, partially swept away by modern denuding agencies, but occurring in patches everywhere. That they refer to a very modern and very general, if not universal, submergence of the land, and this of short duration, there seems no reason to doubt, however difficult it may be to account for it by any causes known to us. Certainly, the attempts to explain it by local land floods, by the waters of melting glaciers, by immense lakes dammed in by ice, and by a greater extent and energy of the existing rivers, have all ended in failure. Perhaps the evidence in relation to it, as it exists in England, cannot be better summed up than in the following

quotation from Mr. Skertchley, of the Geological Survey of England, as quoted by Geikie.[1]

"I must now turn to the palæolithic gravels and sands of Suffolk. They have been described by many previous writers as confined to the river valleys, and to be, consequently, river gravels. This is no otherwise true than that being (naturally) thicker in valleys than elsewhere, they are there worked, and the implements brought to light. In point of fact, however, they spread all over the country, quite irrespective of the drainage systems, crossing watersheds, occupying the highest ground, and running down to the lowest; and at points as widely distant as possible from any water-course I have found implements. These gravels and sands are for the most part quite unstratified, and only show signs of stratification in limited areas. They form wide sandy heaths, which are only useful for rabbit warrens. *Every phase in their character shows that they are the effect of great floods sweeping across the face of the country. They have naturally accumulated in greatest force in the valleys, and as it would be impossible but that streams were locally formed, so we find portions showing stratification and false bedding; but these appearances are by no means confined to the river channels.* They are older than much of the present river valley, for the river has cut through them, and the waste so derived has been re-arranged as true river gravel, and in both, palæolithic imple-

[1] "Great Ice Age."

ments are found, although in the latter case they are often rolled. It seems clear to me that man could not possibly have lived at the time when these great floods swept across the country, but must have been a prior occupant, whose discarded relics were swept up with the other surface matter to form the sandy deposits."

Let it be observed, in conclusion, that this inundation, flood, or deluge, of whatever origin, occurred at the close of the Palanthropic period, and was connected with the disappearance of the men and many of the larger animals of that period, and that it was followed by the advent of the modern animals and the modern men, whose descendants still survive. Let us note also that it extended up to very high levels all over the old continent from England to China, and apparently over North America as well. Such a catastrophe occurring within the human period may well be, as Lenormant calls it in his book on the "Beginnings of History," the "most universal of all the traditions which concern the history of primitive humanity."

A most important topic in this connection, for which little space remains, is the date of this diluvial catastrophe. Since the publication of Sir Charles Lyell's work on the "Antiquity of Man," and that of Croll on the "Glacial Age," and of Pengelly on the "Devonshire Caves," nearly all English geologists have accepted as proved the doctrine of the existence of man for vast periods anterior to

the dawn of history; and by some the possible duration of the human species has been extended over hundreds of thousands of years. It can, however, easily be shown that the astronomical phenomena alleged to bear on this question have no certain connection with it, that the facts of erosion, elevation, and subsidence adduced in support of the longer dates tend in the other direction, or have been misunderstood; so that in a recent paper read before the Geological Society by Professor Prestwich, the best English authority on pleistocene geology, he argues for a very recent date for the close of the glacial period, and in regard to the antiquity of man, falls back on the evidence of history instead of that of geology. I have for many years maintained the recency of man on geological grounds, more especially on the evidence of the absence of any change in organic beings, or any considerable physical changes since his introduction, and of the rate of cutting of river valleys. Evidence of this kind is constantly accumulating, and certain portions of it relating to Bible lands will be noticed in the sequel. For the present I may refer to one chronometer which I regard as giving conclusive testimony. This is the recession of the Falls of Niagara (Figs. 13, 14).

That the gorge of the Niagara Falls is of post-glacial origin, all geologists are agreed, and the fact cannot be doubted. That the present face of the fall recedes at the rate of about three feet per annum

has been proved by the accurate surveys instituted by the State of New York.[1] It is a matter of easy calculation that at this rate the excavation of the present gorge would occupy about seven thousand years, instead of the thirty thousand estimated by Lyell on a supposed rate of one foot per annum. But even this estimate admits of probable reductions. The early modern period was one of greater

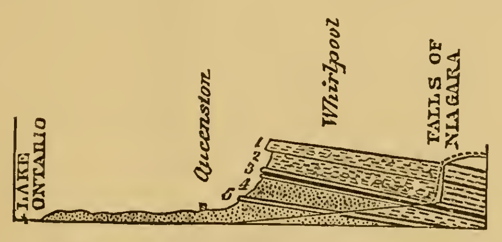


Fig. 13.—Section of the Strata along the Niagara River, from Lake Ontario to the Falls. (1) Hard stratum of Niagara limestone, which preserves the perpendicular face of the Fall. (2 to 5) Soft beds with some harder layers which are indicated by the Falls, causing it gradually to recede. (From *Science*.)

rainfall than the present. The rocks at the lower part of the gorge are less resisting than those on which the river is now operating; and there is evidence that a large part of the gorge above the whirlpool is part of an old channel filled with glacial drift, and merely cleaned out by the modern river.

In accordance with this, Messrs. Humphreys and Abbott estimate the age of the modern portion of

[1] This rate was estimated many years ago by the late Mr. Bakewell, though a slower rate was afterwards assumed by Lyell and others.

delta of Mississippi at 5,000 years, and Forshey calculates that the river would fill the Gulf of Mexico in 100,000 years. Guppy and Woeikoff think that the great rivers of China would fill the Yellow Sea in 24,000 to 28,000 years. Winchell has arrived at

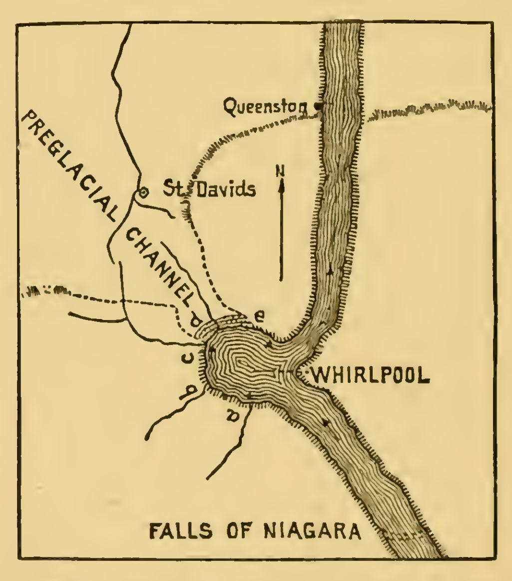


FIG. 11.—Map showing the change of channel in modern times. (*a*, *b*, *c*,) Rock Cliff at Whirlpool; (*d*, *e*,) Old Channel leading to St. David's, choked with boulder clay. (From *Science*.)

results respecting the Falls of St. Anthony similar to those stated above as to Niagara.

Quatrefages makes the following judicious remarks[1] in summing up the evidence derivable from

[1] "The Human Species," 1883.

the more recent formations. "The total age of the earth used, till lately, to be restricted to little more than 6,000 years; but the alluvial deposits of the Saone show that the present geological epoch alone surpasses this by several centuries. On the other hand, under the influence of Darwinian prejudices, men have begun to handle time with a strange laxity, and it has been affirmed that millions of years separate us from glacial times."

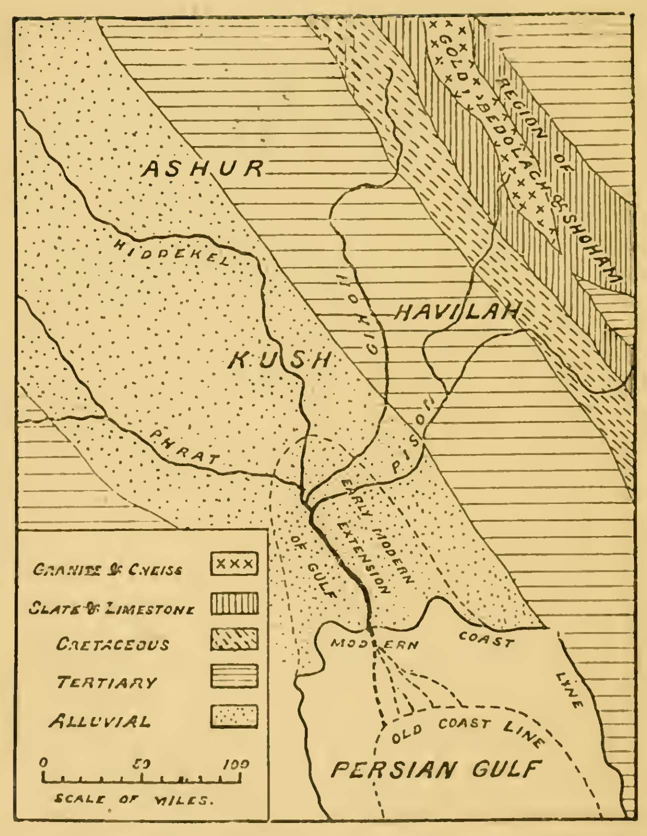
In addition to evidence from the modern period itself, similar conclusions may be reached by referring to what we know as to the whole age of the earth. Sir William Thomson, in a recent lecture at the Royal Institution, has stated that the past age of the sun, whatever theory may be held as to its origin, cannot have exceeded twenty millions of years. Taking this as a maximum date for the sun's age, and making a due allowance for the early vaporous and liquid conditions of the solar system, and of our earth, as shown in the table prefixed to Chapter I., it is plain that this will reduce the whole of geological time, since the formation of the oldest Laurentian rocks, to about six millions of years, or possibly less. Geology can afford data at least for the relative length of its own periods, and applying such time-ratios of this kind as have been calculated,[1] we find that of the six millions, two and a half will be required for the Eozoic age, the same at least for the Palæozoic, and at least three quarters of a million

[1] As, for instance, by Dana and Hull and Houghton.

for the Mesozoic, leaving only a quarter of a million, or say 250,000 years, for the whole Kainozoic time. Of this, the Eocene, Miocene, and Pliocene will require at least 200,000, leaving but 50,000 or less for the Pleistocene and Modern. Thus the Modern proper may well shrink within the limits assigned to it by such calculations as those based on the recession of Niagara. If the reader is disposed to take the trouble, he will obtain a somewhat realistic demonstration of the above facts, by taking a strip of paper 20 inches in length, and dividing it into inches, each of which will represent a million of years. Six inches at one end will then represent all geological time. Of these, five may be marked off for the Eozoic and Palæozoic, three-fourths of an inch for the Mesozoic, and one-fourth for the Kainozoic, while a line one-hundredth of an inch thick at the end will stand for that period of geological time in which man is known to have existed.

Thus, whether we attempt to estimate the chronology of the newer formations, or have recourse to the calculations of physicists as to the age of the solar system, we arrive at somewhat similar results, limiting the time available for the human period, and are able to confine the probable residence of man and modern mammalia on our continents to the ordinary historical computation of six or seven thousand years, and the great post-glacial deluge to a still later date. It is evident also that geology will not allow us to grant the very long periods

claimed by the semi-mythical histories of some of the ancient nations. We shall see abundance of additional evidence of this growing upon us as we proceed. In the meantime, we may conclude that the facts we have been considering, which have led us from the Caves of Lebanon to the Falls of Niagara, and back to the origin of the solar system itself, harmonize in point of time with those of the Bible history. We shall proceed in the next chapter to consider this history in the details which it presents to us.



Map of the rivers of Eden in the Palanthropic age, as described in Genesis, with geology after Loftus.

CHAPTER IV.

EARLY MAN IN GENESIS.

After groping so long in the darkness of caverns, and digging in gravel pits in search of early man, it is a relief to come once more into the daylight and walk with Adam in the Garden of the Lord. We may at least hope to enjoy this pleasure if we are not doomed by stubborn facts to suppose the early progenitors of our race to have been no better than modern Australian savages, or trembling survivors of ice and cold, struggling for existence on the shores of an arctic sea.

We may, I think, at once set ourselves free from this disagreeable prospect. Under any hypothesis of the origin of man, we must suppose that, whatever his subsequent fortunes, he came into the world under circumstances congenial to him. We cannot suppose him to have been either created or developed under conditions in which, with all his acquired arts and stratagems, he finds it difficult to subsist even in a degraded and depauperated condition. He must have come into existence in an equable and

mild climate, and with abundant supplies of food, and must have reached the extreme limits of his distribution in the arctic snows, the mountain tops, the farther ends of the continents and distant oceanic islands, only after long migrations and the impelling power of necessity.

Thus science, as well as revelation, bids us look for the original seats of men in those regions of western Asia which are the historical cradle of all the principal races, and which are also the principal centres of the animals and plants most useful to man. It is worthy of remark here, that Haeckel and others of his school substantially agree with us in tracing the affiliations of men from the region of the Persian Gulf, though to find scope for the Anthroposimians which their idea of evolution requires, they imagine a continental area in the Indian Ocean, now submerged, which has been designated Lemuria, from the family of the Lemurs, animals of a low Simian type, and where they suppose man to have spontaneously originated by development from apes. Unfortunately this region, being submerged, can tell nothing to the geologist, and we have no actual evidence that it ever existed as land. Of course, if we could suppose that man originated in the Eocene or Miocene periods, it might be possible to imagine his birthplace to be much farther north, nay, even in what are now boreal regions ; but we have already seen that there is no geological probability of this, and that we must consequently suppose the original

seats of primitive and naked humanity to have been in at least the warm temperate zone.

The narrative of man's creation in Genesis gives us no uncertain doctrine as to this; and, as we shall see, not only places the first man in a garden, with trees pleasant to the sight and good for food, but in a definite region fixed by distinct geographical characters, and these appropriate to that age of the world in which he appears, and to its known physical conditions.

It is true that nothing has been more disputed than the site of Eden; but it can, I think, be shown that this has arisen from carelessness and inattention to the terms of the description, or from the tendency to convert plain statements into mythical and imaginary stories, and this along with ignorance of the topography and geological history of the districts in question.

In the general account of creation in Genesis i. no special locality is referred to. This is in accordance with the perfectly cosmopolitan character of that document; but we are told that man was to be in the first instance a vegetarian, though to have dominion over animals, and to extend himself over the earth from his centre of creation, wherever that may have been.

In the detailed narrative of the second chapter, however, we have first a picture of a particular state of the land, that bare and unfurnished state in which it rose up from the pleistocene submergence,

when "no plant of the field was yet on the earth," when there was neither rain nor irrigation, but a mist covered the bare land. This was the desolate and nude condition of the continents after the glacial age and the great submergence following it had passed away. But vegetation again took possession of the soil, and animals repeopled it; and, under the kind providence of God, a special area was planted and prepared for man, where he might subsist in peace and plenty till prepared to enter on his great mission ot colonizing the earth. The topography is thus given:—

"And Jahveh Elohim planted a garden eastward in Eden, and He placed there the man whom He had formed. And Jahveh Elohim made to spring from the ground every tree pleasant to see and good to eat, and the tree of life in the middle of the garden, and also the tree of the knowledge of good and evil."

"A river came out of Eden to irrigate the garden, and from thence it divided into four heads (branches). The name of the one is Pison; it is that which encircles all the land of Havilah, where the gold is found; and the gold of that land is good; and there is also found the bedolach and the stone shoham. And the name ot the second river is Gihon; it is that which encircles all the land of Kush. And the name of the third river is Hiddekel (Tigris); it is that which flows before Ashur. And the fourth river is the Phrath (Euphrates)."

The first remark I have to make respecting this

description is, that it refers to the Palanthropic or post-glacial period, that continental period referred to in Chapter II., when the Mediterranean, Red Sea, and Persian Gulf were more limited than at present. It does not refer to the post-diluvial period, when, as we know from the gradual increase of the deposits of the Euphrates and Tigris, the area of the Persian Gulf, though much larger immediately after the deluge, has been contracting. It has not, however, yet attained to the magnitude of its antediluvian condition, when what is now the marshy delta of the Euphrates must have been comparatively elevated and dry, and probably well wooded. This does not affect at all the question of the age of the narrative, which was no doubt written after the deluge—it may be long after it; but it shows that the writer was describing the district as he believed it had been in the early antediluvian time; and if at all well informed by tradition or otherwise, he should be aware of its condition at the time to which he refers. A writer describing to-day the localities of events which occurred in the Bay of Naples before the Christian era, should, in order to describe accurately the scene of the events, have before his mind, not the present state of the shores of the bay, but their state before the great eruption of 79, A.D. If he had no knowledge of this past condition of the place, it would be inferred that his knowledge of the events also would be defective. Bearing this in mind, let us inquire as to the meaning of the description.

In considering any ancient topographical description, it is necessary to ascertain, if possible, the standpoint, or assumed standpoint, of the writer with reference to place and time. This is equally important whether we regard these as real or only imaginary. I do not by any means admit that the standpoint of the writer of Genesis ii. is assumed or unreal. On the contrary, the facts to be stated in the sequel tend to confirm our belief in the antiquity and genuineness of the document, as well as in the accuracy of the writer; but the view now stated is independent of these considerations.

With reference then to the geographical position of the writer of the description of Eden in the second chapter of Genesis, it is, I think, apparent that this is not in Egypt or Palestine, but rather on or near the river Euphrates. This is shown by the manner of his treatment of the four rivers to which he refers. Three of them he describes by ethnical or other characters. The fourth, Euphrates, he merely names, as if no geographical identification was needed. In any topographical description so arranged, it seems fair to assume that the writer might thus define his geographical standpoint and that of his earlier readers.

The position in time assumed by the writer is equally obvious. He is writing of the antediluvian period and of a "garden" or district supposed to have existed in that period, but possibly not existing in his own time. The time of the writer is post-

diluvian, but in that early post-diluvian period referred to in the tenth chapter of Genesis, when the tribes noticed in the description were separating themselves and acquiring distinct territories. Thus we seem to have here a writer who professes to have written at the date referred to in the early genealogy of the sons of Noah in Genesis x., and on or near the Euphrates.

Let us suppose, for the sake of illustration, an old chronicler describing the invasion of Central Britain by the Romans, and remarking that the district is drained principally by four rivers. The first is the Severn, which flows westward toward the country of the West Saxons, where is much valuable tin and copper. The second is the Ouse, which flows eastward into the country of the East Angles, where is much marshy land. The third is the Trent, which flows towards the land of Deira. The fourth is the Thames. Might we not infer, first, that the writer was not contemporary with the Roman Conquest, but with the Saxon Heptarchy, to which his geography refers; and secondly, that his own position was in the south of England, in the valley of the Thames? It might of course remain open to question whether the author of the chronicle really lived in the time and place indicated, or was of later date, and merely simulated an earlier date and a special locality. In either case, however, we should have a right to interpret his description in accordance with the indications afforded by himself.

Treating our ancient description in Genesis ii. in this way, we find that the writer professes to be describing a topography of more ancient date, in terms of his own later time; but that he believes that this topography can be ascertained and defined, at least in a general way, by existing physical and ethnical facts. Let us now examine more minutely what he actually says.

(1) The garden was to the eastward of his Euphratean standpoint. It was "eastward in Eden." It has, I know, been proposed to read the word translated eastward as meaning before or beforehand, but this view is apparently strained, and I believe the general consent of scholars reads it as in both our English versions.

(2) It was in a country or district named "Eden," a word which has usually been held to signify a pleasant or beautiful country; but which Schrader, with reason, prefers to connect with the Chaldean *Idinu*, meaning plain country. In either case we should suppose that some part of the great fertile plain east of the Euphrates is intended, more especially when we connect with it the idea of irrigation, evidently implied in the sequel of the description.[1] It is to be observed, however, that in the antediluvian period this plain may have presented conditions considerably different from those of the time of the writer, and this may account for some of the peculiarities of his state-

[1] The rivers "watered" the garden.

ments. We shall see the evidence of this further on.

(3) It was at or near the confluence of the Euphrates and Tigris, and where these were joined by two other rivers, presumably flowing from the east. It has been supposed that the heads of these rivers may be meant; but this seems to be a forced interpretation of the simple and clear topographical sentence, "From thence it was parted and became, or constituted, four heads."

(4) These rivers were known to the writer and his earlier readers, but in so imperfect a way that three of them required descriptive notes for their identification; and he begins with the most distant and least known stream, ending with that so well known as to need no characteristic.

These preliminaries being understood, let us now inquire as to the rivers intended, bearing in mind that they lie to the eastward of the Euphrates, and become confluent with it near to each other. We may add that, as another of the rivers is well known and generally admitted to be the Hiddekel, or Tigris, we have to look for two rivers only, lying eastward of the latter and connected with it and with the Euphrates near their junction. The only rivers in this relation are the Kerkhar, the ancient Choaspes, and the Karun, the ancient Pasitigris. We must however consider the characters given to the two rivers referred to by our ancient geographer.

The Pison, presumably the most eastern river, and

whose name indicates a spreading or overflowing stream, is said to compass or pass through the whole land of Havilah, and to drain a country producing gold, bedolach, and the shoham stone, which must be local products, and probably products of a rocky or metamorphic country near the sources of the river. As to Havilah, there are two tribes designated by this name in the tenth chapter of Genesis. One of these is of Semitic descent, and of the family of Joktan; the other Hamitic, and of the line of Cush. No information is given of the latter in Genesis x., but there is a note respecting the Semitic Havilah which suggests a connection with the present description. It is said of him and his brethren that "their dwelling is from Mesha, as thou goest unto Sephar, a mount of the east." Sephar has been generally supposed by biblical geographers to be a city and seaport in Arabia; but here it is said to be a mountain, and one lying to the east of the primitive abodes of man in Shinar, so that this identification can scarcely be correct. It is more likely to be the mountainous region affording the products we have just been considering, and perhaps connected with that later Sephar from which the Assyrian kings transported Sepharvaim to people the cities of Israel (2 Kings xvii. 24). In any case the reference of the name to Arabia implies a different geographical standpoint from that of the writer, either in the second or the tenth of Genesis, and is therefore not admissible, whatever facts may

be afforded by subsequent history as to Joktanite tribes in Arabia, to which they may have come in the great migrations of the Abrahamic age. Thus, the Sephar of Genesis x. may well be those Luristan mountains which are the nearest east of Euphrates, and from which the river Karun, a large and important stream, celebrated for the purity of its waters and the fertility of its banks, flows into the Shat-el-Arab or united Tigris and Euphrates. The early abodes of Havilah may have been along this river; and the people of this race may have been the first post-diluvian explorers of the mineral riches of these mountains, as their descendants, perhaps, afterwards were of the mountains of Eastern Arabia. But it will be well, before entering on the discussion of these questions, to inquire respecting the nature of the products referred to.

As to the gold, it is characterized as "good." This raises the question of the distinction in the mind of the writer between good and inferior gold. In primitive times gold occurring in large nuggets, and therefore available for being worked by hammering, was more valuable than that in fine scales or dust; and gold in a state of absolute purity was more valuable than that alloyed with other metals. Again, native copper was sometimes regarded and used as an inferior kind of gold. In some one of these respects, or in all of them, the gold of Havilah was believed by the writer to be of superior quality. According to Loftus, gold occurs in the mountains

of Luristan, drained by one of the tributaries of the Karun; but as to its quality I have no information. This is, however, the nearest gold region to the plain of the Lower Euphrates, and therefore, probably, the country of "the gold" to its primitive inhabitants.

Bedolach is rendered bdellium in our English versions, but it is scarcely likely that a vegetable product should be classed along with two minerals, and we should therefore be disposed to inquire if some stony or similar substance may not be intended. The word unfortunately occurs only here and once in the Book of Numbers; but there are some considerations which aid us in ascertaining its nature. Its etymology indicates something picked out or separated, an indication leading to the idea of small objects obtained by selection from other material.[1] In the Book of Numbers the manna is compared to it, but in a special manner. The "eye," that is the lustre, of the manna is said to be like the "eye" of bedolach. Bedolach must therefore have been well known to the Hebrews of the Exodus as a substance occurring in rounded grains, and having a peculiar lustre. In accordance with these indications, the weight of ancient authority seems to be in favour of the pearl, a view strongly supported with a great number of references by Bochart. In primitive times the pearl was valued,

[1] Our own word "bead" is apparently derived in the same way, from a root signifying to count.

especially for necklaces; and as the use of language was not very critical in such matters, and the pearl, though of animal origin, is of stony hardness, it is probable that shell and stone applicable to the manufacture of beads would be bedolach as well as the proper pearl. In point of fact, in the oldest interments known, there are necklaces made of perforated shells and stones, and even of fossils.[1] Freshwater pearls and pearly shells are found in many rivers; and the mountainous district of the Karun affords various crystalline minerals and pure white gypsum, which might readily be associated with pearls or other material of personal ornament.

The stone shoham, our old translators, as well as the Revised Version, translate "onyx" in the text, and the latter gives "beryl" in the margin. This uncertainty is not wonderful, since even in the Septuagint, whose translators may be supposed to have known something of the substance intended, it is rendered by five different words in the different places where it occurs. Still, the testimony of the Septuagint, when interpreted mineralogically, has a definite significance. In the passage before us it is rendered *lithos prasinos*, prase-like, or leek-green stone. In other places it appears as smaragdos, which among the Greeks was a general name for green ornamental

[1] I have referred in the last chapter to the beautiful necklace, composed of 150 silicified *Turritellæ*, in the Royal Museum at Brussels, which is attributed to the mammoth age, or, in other words, to antediluvian times.

stones, as emerald, malachite, serpentine, and jade. In two other places it is rendered by beryl, which is a variety of emerald. In the only other places, two in number, in which it occurs, it appears as onyx and sardius. In one of them (Job xxviii. 16) it is associated with the sapphire, which was certainly a blue stone, being compared to the sky, and in the other (Exod. xxxv. 8), the stone referred to in connection with the priestly garments is evidently the same with that in Exod. xxxv. 27, where the Septuagint has smaragdos. The testimony of this ancient version is therefore in favour of some greenish stone; and we should here bear in mind that the names of precious stones were in ancient times based on their colour, independently of their composition. To this we may add that Schrader compares shoham with the Babylonian *Samtu*, a valuable stone afforded by the mountains east of Babylonia, and supposed to have been of a dark colour. We may further note that an allied word in Arabic denotes a dart or arrow, connecting this stone with the material of weapons. It is also true that stones of greenish colour, as emerald, malachite, jade, and turquoise, were held in high estimation in ancient times, and that a certain sacredness was attached to them. In Egypt such stones were sacred to Athor, the mother of men; and a similar superstition has extended into the east of Asia, and even into America. This respect for such stones would seem to be founded on the fact that jade or

jadeite, and some allied green minerals, have commended themselves to primitive man in every part of the world, from New Zealand to Alaska and Siberia, as the best material for the manufacture of polished implements and weapons, and as the basis of one of the great steps of mechanical discovery in the primeval stone age.[1]

We may therefore, without much hesitation, consider this primitive list of materials as carrying us back to an early period of Eastern civilization, akin to that which in Europe has been termed the age of polished stone, and may read "gold, bedolach, and shoham," as signifying in that old time

[1] The terms jade, nephrite, and jadeite have been applied to several silicates of magnesia, lime, and aluminium, distinguished usually by a more or less green colour, derived from protoxide of iron, by a close texture, admitting of a fine polish and of a sharp edge, and by considerable hardness and toughness, characters admirably adapting them for the manufacture of weapons and cutting instruments. The more highly coloured and translucent varieties are also well adapted for purposes of ornament. The use of these minerals in primitive times, and among rude peoples, has been almost universal; and in districts where they could not be obtained, they have been articles of commerce. Professor Putnam has noticed the occurrence of jade implements in British Columbia, in Michigan, and from different localities in Central America, and has supposed that it was derived from Asia; but Dr. G. M. Dawson has shown that in British Columbia, at least, it is of indigenous origin, and Professor Meyer had previously established the same fact for Alaska. Thus it may be said that the valuable properties of jade have been recognised by rude races in all historical periods and in all parts of the world.

the native metals, the materials of beads or wampum and of personal ornament, and the stone most useful for implements and weapons. In other words, we may translate the words, "gold, wampum, and jade,"—terms which in any primitive state of society would include all that is most precious in the mineral kingdom.[1] We have now before us the question, In what region east of the Euphrates can these precious products be found?

Some information on this subject was obtained by Ainsworth, the geologist of the Euphrates expedition,[2] but much more full descriptions of the geology of this region have been given by the late William Kennett Loftus, of the Turco-Persian Frontier Commission,[3] a man equally distinguished as a geologist and archæologist. According to Loftus, the alluvial and marine plain east of the Tigris is bounded by a tertiary formation of gravel, sandstone, and marl, containing large deposits of gypsum, which was extensively used by the Assyrians for architectural and ornamental purposes. In the gravels of these deposits are many pebbles, derived from the rocks next to be mentioned, and which might have been

[1] It should be mentioned here, that in the Revelation of St. John, just as the river and trees of Eden reappear in the New Jerusalem, so do the "gold, bedolach, and shoham stone" in the golden streets, the gates of pearl, and the foundations of precious stones. We have thus an amplification and apostolic explanation of this part of the story of Eden.

[2] "Researches in Assyria, etc., 1858."

[3] *Quarterly Journal of Geological Society*, vol. xi.

used in early times for the making of implements. The gypsiferous series forms low hills, succeeded to the eastward by a great formation of limestone, the nummulitic limestone of the Eocene period, attaining in some places an elevation of 9,000 feet. Succeeding to these, after the intervention of lower beds referred to the cretaceous and palæozoic series, there occur in the mountains of Luristan clay slates and micaceous schists, with crystalline limestone, associated with which are granite and porphyry, and various kinds of trap. In the streams traversing this older formation gold is found,[1] and there are precious garnets, beautiful green serpentine, and a hard dark-green jade, or a green chert. The important point for our present purpose is, that these metamorphic and crystalline rocks, which form the highest hills of Eastern Persia, afford the products referred to in Genesis ii., and that this is the nearest district to the Euphrates in which these products occur. Further, the river Karun, the ancient Pasitigris, originates in these hills, and is the only river of the region that does so, and it empties into the Shat-el-Arab, the stream which arises from the confluence of the Euphrates and Tigris. Thus we are able to find a river answering to the Pison of our old geographer, and which, while flowing from mountains rich in mineral products, is in its lower portion a spreading or overflowing river, watering

[1] In the Elwend Mountain, and probably in the head waters of the Diz, a branch of the Karun.

one of the finest countries in the world, and on the banks of which was situated the city of Susa, the capital of ancient Persia—a place celebrated for its beauty and the fertility of its environs, and the site of the winter palace of the Persian kings. To the early dwellers in Mesopotamia, the valley of the Karun afforded fertile soil and scenic beauty, and by following it up they would reach the nearest district of metamorphic rocks and mineral riches.[1]

If the Pison of our narrative be the Karun, then the second river, the Gihon, the rushing or rapid river, must be the Kerkhah, the ancient Choaspes, a river of considerable magnitude and importance, though inferior to the Tigris and Euphrates. This stream intervenes between the Karun and the Tigris, and its head waters do not reach so far into the mountains as those of the former river. This is

[1] I have examined the collections of Loftus, which are in the museum of the Geological Society of London, and which fully bear out his descriptions. The specimens, however, require microscopic and chemical examination, as it seems probable that some of those classed as hard green serpentine and green chert are really varieties of jade. Loftus says, "If a traveller approach the dominions of the Shah from the Persian Gulf, or from Lower Mesopotamia, he must cross the vast range of the ancient Zagros, and invariably meet with the part of the section exhibited in Fig. 1" (of his Memoir). This section, showing the rocks and minerals referred to in the text, is that which the earliest explorers would find as they wandered up the Karun, and its tributary the Diz, and which would introduce them to a region of mineral products quite different from anything to be found in the Euphratean plain.

an important point, as in the ordinary maps of the district the reverse is the case; but on referring to the geological map prepared by Loftus from personal surveys, we find that it is really the Karun that penetrates the metamorphic country, so that the topographical geology of Genesis is more accurate than that of most of the maps in our modern atlases.[1] The Gihon is said to compass the whole land of Cush; not an African or Arabian Cush, but that primitive Cush noticed in the tenth chapter of Genesis, and which under Nimrod founded the first Chaldean empire in the plain of the Euphrates. If the Gihon compassed the Cushite territory, this early empire must have extended across the Tigris, nearly to the foot hills of the Persian mountains; but in this there is nothing improbable. The fact that Cush is said to have had a son named Havilah may, however, have some significance in this connection. It is also interesting to note that the Kerkhah compassed the land of the Cossai of classical history, and flows through the modern Khusistan.

We thus find, that if we place our ancient geographer where he places himself, and suppose he refers to the Euphrates and the three principal rivers confluent with it near its entrance into the Persian Gulf, we obtain a clear idea of his meaning, and find

[1] It is scarcely necessary to say that Loftus, in his explorations, had no special reference to the identification of the rivers of Eden. The map prefixed to this chapter gives the topography and geology as ascertained by him.

that, whatever the sources of his information respecting the antediluvian Eden, he had correct ideas of the Idinu of his own time, and of its surroundings and inhabitants. According to him, the primitive seat of man was in the south of the Babylonian plain, in an irrigated district of great fertility, and having in its vicinity mountain tracts abounding in such mineral products as were of use to primeval man. It is not my purpose here to vindicate the accuracy of his statements, but I may shortly refer to some questions that may arise concerning them.

It has been objected to the Babylonian site of Eden, that there is evidence that in pleistocene times the Chaldean plain was under the sea, and that the encroachment of the alluvium on the head of the Persian Gulf is so rapid as to prove that in early historic times the Euphrates and Tigris were separate streams. But this objection neglects the fact that between the pleistocene submergence of the country and the modern period there intervened that continental age in which all Europe and Western Asia were more elevated than at present, and the Babylonian plain must have been higher and less swampy than it now is, while it is probable that the mouths of the Karun and Kerkhah were better defined and nearer to each other than they now are. It is probable that this time of continental elevation was that of antediluvian man, and that, consequently, to which our writer refers. We must, therefore, in order to realize the exact geographical

position of Eden according to Genesis, imagine the shallower parts of the Persian Gulf to be dry land, the Shat-el-Arab to be longer than at present, and the country on its banks dry, though capable of irrigation, and clothed with open woods; while the climate would be more equable than at present. This was undoubtedly its condition in the early human period at the close of the Pleistocene, and must have been known to or imagined by the writer of the early chapters of Genesis. In Haeckel's curious map of the affiliation of mankind[1] he agrees so far with our ancient geographer, but stretches the primitive abode of man farther to the south, over an imaginary continent of "Lemuria," supposed to be submerged under the Indian Ocean, but of whose existence Wallace has shown that there is no good evidence.

There is a curious biblical connection between this district and the earliest history of post-diluvian man. The ark of Noah, we are told, grounded on the mountains of Ararat, and immediately after the deluge, the survivors moved southward and westward, and settled themselves in the plain of Shinar. This would be natural if to them Shinar or its vicinity was the site of Eden. Further, this post-diluvian migration from the hills of the north has fixed itself in the traditions of men, as Warren has argued in his ingenious but fanciful book, "Paradise Found," in which he gives to the fact, contrary to

[1] "History of Creation."

the Bible history, an antediluvian bearing. Lenormant has illustrated this,[1] and has shown that the Chaldean, Persian, and Indian traditions, of the origin of man in northern mountains are really postdiluvian. Lastly, this early migration serves to illustrate the promise made to Noah that "all flesh should never again be destroyed by the waters.[2] Without faith in this, it is little likely that the survivors would have left their comparatively secure mountain retreats and ventured again to settle in the plains.

Another important question relates to the ideas of our ancient authority respecting the minerals he mentions. Did he suppose that these were important to Edenic man, or are his notes respecting them intended merely to identify the river Pison? It would seem likely that the former is the true explanation. Just as he informs us that Eden contained every tree pleasant to the eye and good for food, so it would seem that he wishes to inform us that the "precious things of the lasting hills" were also accessible. Man, he tells us, was to dress the garden, and keep it, and even Adam may have required stone tools for this purpose, while there can be little doubt that the fig-leaves and dresses of skin would soon be followed by feminine attempts at ornament. It is further to be observed that Cain is said to have fled to the east after the murder of his

[1] "Ancient History of the East and Beginnings of History."
[2] Gen. ix. 11.

brother, and this would bring him to that mountainous country which contained the mineral treasures referred to, and of which, according to Genesis, his descendants so soon began to make use. Thus there is nothing contradictory in these ancient accounts, but the whole hang together with perfect consistency. They are also consistent with the curious Babylonian tradition, that Noah hid the documents of the antediluvian world at Sippara, a name probably connected with Sephar, and that he himself, or his spirit, still lingered at the mouth of the Euphrates, as if watching the slow retreat of those waters which in his time had overflowed the world.

Finally, the conclusions above reached are not very novel or startling, being near to those of Calvin and Bochart, and of Pressel in more modern times; and, while they limit the geographical horizon of our ancient author, and do not imply that he had any information as to rivers so distant as the Oxus and the Indus, they serve to place the whole of the statements respecting early man in harmony with each other and with geographical facts, and to show that the documents embodied in these records are of great antiquity and historically accurate, unless indeed we prefer to believe that their writer was a consummate master of the art of simulating antiquity, and wonderfully fortunate in anticipating discovery; or, on the other hand, that he was supernaturally enlightened as to matters not otherwise known to him.

The site of Eden being thus definitely fixed, and the time being that of the greatest extension of our continents, we cannot wonder that in the two thousand years or so which intervened between the first man and the deluge, the human race had pushed its way to the Atlantic on the west and to the Pacific on the east, and as far south and north as the habitable land extended. In connection with this, it must be borne in mind that the condition of the continents was eminently favourable for migration by land, and that this is evidenced by that remarkable association in the same deposits of remains of animals now widely separated, to which we adverted in the last chapter.

It remains for us in this chapter to consider certain parallelisms between the record of geology and the Bible with reference to the social and industrial state of man, the effects of the fall, the characteristics of the antediluvian nations, and the tradition of the deluge.

That man in Eden was socially and industrially in the most primitive possible state we cannot doubt. Destitute of clothing and of shelter other than that afforded by the trees of the garden, without weapons and implements; at first, as we shall see, perhaps even without language; he was, in so far as inventions and industrial art are concerned, in a position inferior to that of the rudest savages at present. Yet this condition was not incompatible with the moral purity implied in his state of innocence.

Very soon, however, his inventive powers would supply him with such implements as he required; and the expulsion from the garden introduced him at once into that struggle for existence in which he has ever since been engaged, and which would greatly quicken his inventive faculties. Already, in the first generation we read of agriculture, carried on no doubt with implements of stone or wood, of the taming of animals, of the use of skins as clothing, implying the employment of stone knives and possibly some art of dressing skins and of needlework. The region, as we have seen, is not one of flints suited for chipping, and it is not unlikely that chips of jade and other hard stones, and polished edges of the same, were the first cutting implements.

Let it be observed here further, that the family relationship was already established, but not that which is tribal; and here there is a note of contradiction between certain modern theories and the Bible story, as well as the common sense probabilities of the case, which deserves attention, and which we must keep in view throughout. It is well known that there has been much controversy on the original constitution of human society, and the institution of marriage. The late Mr. J. F. McLennan and Mr. Morgan have brought into prominence the totemism and descent in the female line peculiar to certain ancient and rude nations, as well as the practice of exogamy, or marrying a person of a distinct tribe, and that of wife capture. These customs prevail in

nations as remote from each other as those of North America and Australia, and are unquestionably very primitive. There is, however, nothing in this at variance with the prevalence in primitive times of the patriarchal system, as implied in the Bible, and practised from time immemorial in the East. Nor is there any proper justification for the idea of a previous state of "Matriarchy," as it has been called, preceded by a state of merely promiscuous intercourse. The oldest human beings known to us, those of the caves and gravels, evidently lived in communities; and we have thus a right to regard man as from the first a social or gregarious being. But, living in society, there must have been some head to the family, and such head would naturally be the person of greatest age and experience; while in times of danger the adult males would as naturally come to the front, and would be led either by the patriarchal head or, failing him, by the person of most influence and energy. Further, the long period of helplessness of the human infant necessitates parental care, and therefore some family arrangements. Thus the patriarchal system, or the rule of parents and elders, must have existed in the first human family. But so soon as the family increased to a tribe, or aggregation of tribes, questions as to marriage must arise, and then came the law of marriage, as expressed in Genesis, that a man should leave his father and mother and cleave unto his wife, and that they two should be one flesh. In other

words, the man had to belong to the tribe of his wife, and the woman became the head and centre of the household. When distinct tribes came to have their separate totems or emblems, and to constitute separate communities, then arose the case of marrying into another tribe, or exogamy, as a consequence, perhaps, of the observed evil effects of too close consanguinity in husband and wife. It is interesting to note that these facts are implied in the early chapters of Genesis, and are referred to by our Lord in arguing with the Jews on the law of marriage. The doctrine of Genesis on this subject casts in truth a bright light on all the questions of marriage and the position of woman, which we may carry with us through the whole as a lantern to guide our steps, even in these modern times. Man was made in the shadow and likeness of God, His representative in this lower world. But what of woman? "Male and female created He them;" and man in this double capacity was to replenish the earth and subdue it; not its slave but its master—"treading it under his foot," as the words literally are. Man and woman were to do this, so that the woman as well as the man shares in the high distinction of being the image and likeness of God; and it is in the family relation, and this alone, that such manifestation of God, and the consequent subduing of the world, can take place. Going a step further, we find this developed in that remarkable law of marriage, which has received less attention from

historians and theologians than it merits: "Therefore shall a man leave his father and his mother, and shall cleave unto his wife." Here it is the husband who goes with the wife, and she, as the centre of the family and the mother of the children, is the true husband, the bond of the household. That this is the actual Edenic position of primitive woman could be proved by incidents in the history of the patriarchs, by the customs of many ancient peoples, and by the fact that even in such rude and isolated tribes as the wild Indians of America this aboriginal idea of marriage still lingers in customs which, however degraded, are sad and pitiful reminiscences of unfallen man. But I need not take time to enter into such proofs, for we have the testimony of One whose own title of the "Seed of the Woman" looks back to the time when descent was in the female line. Our Lord Himself took occasion in His ministry to recall the memory of this great and fruitful fact. The Pharisees, most self-satisfied men, wise in their own wisdom, and case-hardened in their own orthodoxy as the most earnest bigot of our own day, came to Him with the question, "May a man put away his wife for every cause?" saying in effect, "Woman is the slave of man; may she be treated with any injustice, dismissed for any caprice, without offence to God?" Our Lord, in His answer, takes them back to Genesis and to Eden. "Have ye not read," He asks, that He who made them, both the man and the woman alike in His own

image, and instituted the distinction of sex, enacted its law, and that law was, "The man shall cleave to his wife"? That is God's order. Is there any place in it for putting away? Nay, if there were such, would it not rather be the woman that could put away her husband than the husband the wife? How strange, that in our worldly wisdom we overlook the simplest, plainest truths, and need a Divine messenger to point them out to us! But, objected the Pharisee, that is not what Moses said; and we may object, it is not what Paul said about the subjection of woman. Our Lord has His answer to this too. It is "because of the hardness of your hearts, but from the beginning it was not so." The original equality of man and woman was, like so much other good, broken down by the fall, which brought, among other woes, the subjection of woman, too often developed into tyranny and injustice to her. In a hard, fallen world of labour, struggle, warfare, and danger, woman necessarily becomes the weaker vessel; and her original dignity of child-bearer, which gave her in Eden her high position, and which, even after the fall, is sought to be retained in her prophetic destiny as the potential mother of a Saviour, becomes in all savage and rude states of society an additional cause of weakness and disability. Hence one of the great missions of Christianity is to restore woman to that place which she had in the beginning—to deliver her not only from the slavery of savagery, but from the contempt of

Phariseeism and pedantry ; and just in proportion as the law and love of Christ prevail will these ends be secured. But not until He who is the woman's Seed shall reign absolutely on the earth, will all traces of this evil be removed—an evil at once sad in its effects on woman and most degrading in its effects on man. Practically, in Christianity as promulgated by Christ and His apostles, woman is recognised as the ruler of the house, the centre of the family, which is the oldest, holiest, and highest of all institutions. She is removed from the more public offices of rule and government, but has acknowledged rights of service, and shares with man the higher gifts of prophecy and song, which are not extinct among the good women of modern times. Here, then, we have reached the ideal of the position of woman—the Edenic ideal of the equal helpmeet of man, the shadow and image of God—the Christian ideal adapting all this to an imperfect yet improving world, and holding up before us the Christian daughter, sister, wife, and mother as the most beautiful of moral pictures, as the pillars of God's family, the noblest representatives of Christ's cause in the world. Thus the oldest account of the condition of primitive man carries with it all that can be learned or done in regard to the relations of the sexes in the highest Christian civilization.

But it may be said, all this was very imperfectly realized in the early tribes of the caves and gravels ;

and this leads us to consider the Bible explanation of the manner in which the human race came to be what we actually find it, and the vicissitudes through which it passed in the antediluvian period.

The fall of man wrought a change of which we have unhappily too many illustrations, when temptation and sin change the trusting, simple child into the debased victim of appetite, or the man of violence and deceit. It opened up to humanity infinite avenues of elevation and degradation, which were followed far in the antediluvian age. The temptation came through fruit—ordinary food; perhaps, as the Hindu tradition has it, a fruit having intoxicating or stimulating properties.[1] The agent of the spirit of evil in the temptation is a serpent, of all animals the most subtil—the one which is the wisest, in that it can, without limbs and with its wondrous gliding motion, walk, run, swim, climb, leap, do all that other creatures can do, and more. All this is perfectly natural and simple, and in accordance with the probabilities of such a case, so hard for us to realize in our present state. The fall leads to the first murder, a sin of violence and anger, stimulated by jealousy and hatred arising out of that relation to the heavenly Father which should be the fountain of brotherly love:—a prototype of too much that this bad world has since seen.

The first murder makes Cain a fugitive, and leads to a division of men into two races, at first, appa-

[1] The Soma tree, said to be an asclepiadaceous plant.

rently altogether separate from each other, the Cainite race settling eastward in the rich country at the base of the Persian mountains, and in command of the treasures of gold, bedolach, and shoham stone in these mountains; the Sethite race in or near the original Euphratean Eden. Respecting the history of the latter we have little information, except what relates to their religious condition. We may infer that they were quiet, sedentary, pastoral, and agricultural people, following the traditions taught them by Adam and Seth. A few points in their record are interesting, and will aid us further on. We are told that in the days of Enosh, men began to invoke the name of Jahveh, a religious change which, as we shall find, leads us to understand the true meaning of the mysterious story of the marriages of the sons of God and the daughters of men, and also, if we are not mistaken, lies at the root of the distinction of what are called "Elohist and Jahvist documents." The primitive Elohim worship was probably degenerating into polytheism or nature-worship, and a change was made in favour of a direct appeal to Jahveh as the Saviour and covenant God. At a later date the men of that race had their attention directed to the reality of a future life by the example of Enoch, who walked with God and "was not, for God took him." Still later, Lamech's prophecy as to Noah as a comforter directs our attention to the increasing difficulty of obtaining sustenance out of the ground, and the hope of a

comforter or deliverer to introduce a better era. These may be regarded as three successive revelations coming to the Sethite people as the inheritors and pioneers of true religion.

More details are given of the Cainites. First, we may infer from the curse on Cain, that his posterity may, like himself, have been to some extent wanderers and rude hunters and trappers,—"fugitives and vagabonds," and to whom "the ground would not yield its strength." It was, perhaps, to avert or arrest this doom, that Cain established himself in a city or fortified station; or perhaps this indicates that already, in his lifetime, the wild passions of savage men were making life dangerous. Cain's city was probably built in that pleasant region where Susa or Shushan, the winter capital of the Persian kings, was afterwards placed. So far, however, the policy of Cain was successful; for it was, no doubt, in connection with the citizen population situated in a country rich agriculturally and in mineral products, that those great inventors, the sons of Lamech, arose. There the musical talent of Jubal added new pleasure to life, and the art of Tubal-cain learned to forge cutting instruments of metal, superior to those of stone. From these communities also sprang the institution of a nomad life by Jabal—a better method of wandering than that of the houseless cave man and wandering hunter, and involving the domestication of some of the more powerful beasts of burden, —probably, from the region referred to, of the ox

and the ass, possibly of the horse or the camel. The subsequent deluge narrative seems to assume that many of these inventions spread among the Sethite population.

Still the two populations, Cainite and Sethite, kept distinct, each following its own course; and now comes that remarkable episode, introductory to the great flood, which has been truly called the *crux interpretum* of this part of Genesis—the intermarriages of the "sons of God" with the "daughters of men," and the consequent production of a gigantic, energetic, and warlike race. A naturalist may be pardoned for at once discarding as impossible, if not absurd, that theory, dear to some theologians, that the sons of God here are fallen angels, or superhuman beings of some kind, intermarrying with the daughters of ordinary men. The mythologies of many ancient peoples present such ideas; but they are scientifically absurd, and our old Genesis record is not a myth, but evidently an attempt to relate plain human history. The other interpretation, however, that the sons of God (*bene ha elohim*) are Sethites, and the daughters of men (*benoth ha adam*) Cainites, is also attended with insuperable or nearly insuperable difficulties, although it is easy to find passages in the subsequent Hebrew scriptures in which good men are called "sons of God," or "children of the Most High."[1] What alternative,

[1] Deut. xiv. 1, 2, xxxii. 4, 5, 19, are perhaps the cases most in point.

then, is left to us? Simply to take the words as they stand, and in connection with the institution of the Jahveh worship among the sons of Seth, as already mentioned. The words are:—

"It came to pass as men (*ha adam*) began to multiply on the face of the ground, and daughters were born to them, the sons of God (*bene ha elohim*) saw the daughters of men (*benoth ha adam*) that they were beautiful; then they took for wives among them, all those who pleased them.

"And Jahveh said, 'My Spirit will not prevail always with man (*adam*), because he is flesh; and his days shall be 120 years.'"

"The giants (*nephelim*) were on the earth in those days, and also after that the children of God came to the daughters of men, and these had given them children; they are the heroes (*gibborim*) of antiquity, men of renown."[1]

Now, who are the men (*ha adam*) of the beginning of this extract, and the man with whom God's Spirit would not always strive. Clearly, I think, the Sethites, the worshippers of Jahveh; and this, let it be observed by the believers in documents, is a Jahvist extract. These are the legitimate progeny of Adam through Seth, and the Jahvists of their time. Who, then, are the *bene ha elohim*, the sons of God? Just as certainly the Cainites, still worshippers of Elohim, but probably now in a corrupt and materialistic form. It seems to me that this

[1] Gen. vi. 1–4.

must be the meaning of the writer, and that it solves the whole mystery. Under this light some other points become instructive. The superior beauty of the daughters of men implies a finer type on the part of the Sethites. Again, the wives were "taken," probably by capture from a weaker and a more peaceful people. Further, in violation of the primitive marriage law, they were taken into the tribes of their husbands. This, again, implies a superior power on the part of the Cainites, enabling them to enslave the other race, as well as the introduction of a great social innovation which became general in later times. The children of these marriages, as was natural in the case, were a race of half-breeds, more energetic, and it would seem of greater stature than the pure races. Finally, all this led to a corruption of manners and morals on the earth, which caused Jahveh to doom its inhabitants to destruction in one hundred and twenty years—not to shorten the life of man to that term, which is contrary to all the other testimony of our record, and to the plain import of the words when taken in their connection.

We are now in a position to inquire as to the relation of all this to our palaeocosmic men. Do the Canstadt and Cro-magnon races represent any of these diverse antediluvian peoples, and if so, which of them? Here we must notice that we know something of the physique of the Sethites. Noah was certainly of this race, and so were the other members

of his family; unless, indeed, any of his sons' wives may have been of the mixed stock. If so, then the early Chaldean and Egyptian peoples, whose features are well known to us from a very early period, may be taken as representing the Sethites, who will thus be a modern people. No such people are, however, known to us in the cavern or gravel deposits; and if by any rare chance a skull of this kind were found, it would run the risk of being set down as Neolithic. It is, however, to be observed that the Sethites were probably somewhat limited in their distribution, and that it is only in Western Asia that we can hope to meet with remains of peoples of this type. Our Canstadt and Cro-magnon men must therefore be Cainites, or perhaps the former may represent the pure Cainite type, and the latter some mixture with the other race. The tall Cro-magnon men would certainly correspond very well with the gibborim or giants of the writer of Genesis. Further, we have as yet no examples of the more civilized Cainites, if their civilization is to be inferred from their building cities and using metals, though it is quite likely that such a station as Soloutre may be an adequate representative of an early Cainite city, and that implements of stone would be vastly more numerous than those of metal; and they certainly are more durable. In all probability our cave and gravel men are of those wandering hunting tribes on whom the doom of Cain fell to the uttermost, and who descended to lower and lower grades of mere barbarism as they

wandered farther from the primitive seats of humanity.

If this is the real parallelism of geology and Bible history as to early man, we have still much to learn beyond the results of our present cave-hunting, and may be prepared to find somewhere, antediluvian men of higher type than those hitherto discovered.

Curious questions occur in connection with this, as to the possible survival of some antediluvians, and as to the genealogy of those old Palestinian peoples who seem to have preceded the Canaanites, and whose descent is not given in Genesis x. Were they a remnant of the old *bene ha elohim* of the antediluvian times? We have not as yet facts to determine the question, and must, in any case, first consider the history of the deluge itself.

We have noticed in a previous chapter the general geological evidence as to the post-glacial flood, an event of which the tradition survives in all the great races of the earth, except, perhaps, some of those of Africa and the Pacific Islands; and our biblical account of it has recently been reinforced by the testimony of the ancient Chaldean tablets.

The account of the flood in Genesis, chapters vi. to ix., is very detailed in comparison with other histories in the early part of that book; and it is usually stated that it consists of two documents, one Elohist, and one Jahvist, welded together by a subsequent editor. On this I would remark, that if

it is correct, there would seem to have been two independent histories open to the editor, and that one of them may have represented the fortunes of the Cainite, the other, that of the Sethite race. This appears from the fact that in the opening of the sixth chapter it is the sons of Adam, properly so called, who are the special objects of wrath, and this is the wrath of Jahveh. If nothing more had been said, we should have inferred that the Cainites, the sons of Elohim, were left to suffer the curse of Cain, and were not subjects of this new judgment. But as the narrative goes on, Elohim also is introduced, and no distinction is made between Elohim and Jahveh. I do not of course suppose that in the mind of the writer Jahveh and Elohim were two distinct Gods, but the one was God in the aspect of Redeemer, the other in that of Creator. The one was the name specially venerated by the Sethites, the other by the Cainites. Thus, God, in all aspects and in all relations, is represented as concerned in the great judgment. If, therefore, the theory of two documents is well founded, the intention of the editor must have been more fully to emphasize the universality of the destruction as relating to both great sections of the human family. It may also be observed that if we separate the supposed documents, we shall find that, while both have the form of testimony of eye-witnesses, the Elohist portion is the more detailed as to the physical phenomena, and that this corresponds to the fact that Elohim

represents God specially as the Creator of the universe.

Without concerning ourselves further as to this question of different documents, we may remark certain points as to the deluge, which are important in a topographical and scientific point of view. The first is, that the narrator represents himself to be an eye-witness of the catastrophe. No other inference can be drawn from such expressions as that "the waters increased and lifted up the ark, and it was raised above the earth;" "the waters strengthened, and the ark began to move;" "fifteen cubits upwards the waters rose, and the mountains were covered;" "the waters retreated, departing and withdrawing themselves." These, and a variety of notes scattered throughout, are statements derived from an eye-witness, or one who represents himself as such. This is a most important consideration, as it serves to explain the meaning of such expressions as imply universality, since these must refer merely to the experience of the observer—all visible to him was covered, and all its creatures destroyed. The narrative may have been purposely kept in its present form, to prevent misconception on this point.

Another important remark is, that the deluge is not a mere river inundation. The rivers, indeed, are not mentioned, but only the springs of the abyss and the rain. The described appearances also are those of a great marine, rather than fluviatile inundation. This accords with a geographical indication,

the only one in the narrative. The ark rested on the mountains of Ararat. Now, Ararat was undoubtedly somewhere in the high lands of Western or Central Asia; and to reach such a position, if Noah's residence was in the original seats of human population in the Euphratean valley, the ark must have drifted northward, or against the natural drainage of the country, a statement inexplicable, unless the writer intended an actual submergence of the land.

The duration of the deluge in round numbers was about a year, but this no doubt represents its culmination in the district occupied by Noah and his family. We have a right to assume that for at least the whole term of one hundred and twenty years between the first announcement and the final catastrophe there may have been a gradual encroachment of the waters and disappearance of the land, culminating in a great submergence, which must certainly have been very general, though not universal. If we are to take the loess and other post-glacial deposits as its measures, all the countries between the Mediterranean and Indian Ocean, and great interior mountain chains of Europe, Africa, and Asia, must have been submerged; and the remnant of the animal population that survived, independently of the selected creatures in the ark of Noah, must have been small, though enough to replenish the earth with that diminished fauna which it possesses at present.

I may add here an important note. After the deluge, the first settlement of the Noachidæ was in the mountain region where the ark had grounded. Here vegetation would be comparatively intact, and men seem to have become acquainted, perhaps for the first time, with the vine; perhaps with other productions of the mountains and table-lands not previously penetrated by man. So soon, however, as the lower valleys had been dried up and their vegetation restored, men—encouraged, no doubt, by the prediction of Noah that the flood would not return, and stimulated by the traditions of the fertility of the old Edenic regions—migrated downwards into them. This is the great migration from the mountains of the north already referred to, and which, like the tradition of the flood, has remained with the people of Asia. It is this which has led to the unfounded impression that these traditions indicate a northern locality for the original abode of man in the antediluvian time. After what has been said, it is not necessary to point out the remarkable agreements of the Bible and observation with reference to the deluge, or the light which they mutually cast on each other. It still remains, however, to inquire as to the arts of the antediluvians and their relations to certain localities and to post-diluvian history.[1]

[1] It has been remarked by archæologists that the palæocosmic men were more artistic than the early neocosmic men, and apparently less religious. This agrees very well with the respec-

The accounts of man in Genesis concur with the evidence of the caves and river gravels in representing the earliest men as different, in many respects, from their successors, whether savage or civilized. As described in Genesis, primitive man is morally innocent (ii. 25), incapable of associating on equal terms with the brutes (ii. 20), destined to rule over them (i. 28). His food was originally seeds and fruits, not flesh or mere herbage (i. 29, ii. 9); but soon after the fall we may infer, from his skin clothing and his keeping flocks, that he had acquired the taste for animal food. He was naked; destitute of shelter and of implements, except such as natural wood or stone could furnish. At a very early period, however, he must have acquired those simple arts of chipping and polishing stone, antler, and bone, of which we find evidence in his earliest remains.

It would seem, as already hinted, that the fall and its consequences, in the banishment of man from Eden, and the separation of Cain and his family, gave a great stimulus to invention. It led to clothing, tillage, domestication of animals, buildings, metallurgy, and other arts in rapid succession; and it would seem that the earliest history of our race must have been more fertile in invention than any that has succeeded it, unless, indeed, we

tive characters of the Cainites and Sethites in the Bible; and if the latter alone survived the deluge, their ruder migratory tribes must have been the men of the early Neanthropic age.

are to suppose that it was of indefinitely long duration. But such indefinitely long duration, we have already seen, geology will not grant, though there is what may be called an evolutionary superstition, which seeks to account for all progress by slow and indefinite gradations, as if mere lapse of time were an efficient cause. We may test this doctrine by a consideration of the origin and progress of arts and of language, as these are stated to us in the Bible, or as they are evidenced in the fossil remains of early men. The Bible theory of inventions is, that they result from the action of great or special minds working out some new problem that has baffled or has not occurred to others. Such men are Tubal-Cain and Jubal; and similar to this is the history of invention in modern as well as ancient times. Further, the new inventions—sprung upon the world by inventive genius—fall into the hands of ordinary men, who carry them on indefinitely, without improvement, until some new genius arises; and, after all, the first stride in such matters is usually something far greater than any subsequent advance. Hence it comes to pass that human progress is a series of leaps, followed by indefinite persistence. If we apply this to the early arts of prehistoric men, we find the use of chipped stone an early invention, and persisting to this day all over the world, wherever it exists or has existed, with precisely the same forms as those which were developed in antediluvian times. The making of

pottery of clay mixed with sand, and spread out and doubled in pastry-cook fashion, so as to give it tenacity, and ornamented with chevron and basket patterns, has extended unchanged throughout the world. Who invented the throwing-stick for spears, the harpoon, the boomerang, the bow, the drill? All these have come down to us from post-glacial times, and no one has been able to improve on them to any appreciable extent. Who discovered the needle and thread and the art of sewing? and who, until the modern invention of the sewing-machine, has improved on them? The like may be said of the arts of knitting, netting, and basket making. In the earliest times the most suitable species of animals were domesticated, and the best grains and fruits selected and cultivated, and scarcely any advance has yet been made in these matters. Another invention of early man is that of money. I do not say that this was antediluvian, though the mention of "bedolach" in Genesis, and the pierced shells found in palæocosmic graves, lend some countenance to such a theory. In any case, shell-beads or other forms of wampum constitute a currency so general that the invention must have been made in very early times. In a recent paper[1] Mr. Horatio Hale has connected the cash of the Chinese with the shell money of the Pacific, and the similar currency in use all over America. He does not seem to be aware that wampum similar

[1] *Popular Science Monthly*, January, 1886.

to that of America is found in the graves of the Guanches of the Canaries (Fig. 15), who must have derived the art from very early European or African sources. Here, again, we have an early invention preserved among the Chinese to this day. Does not all this show, not a slow and gradual progress, but

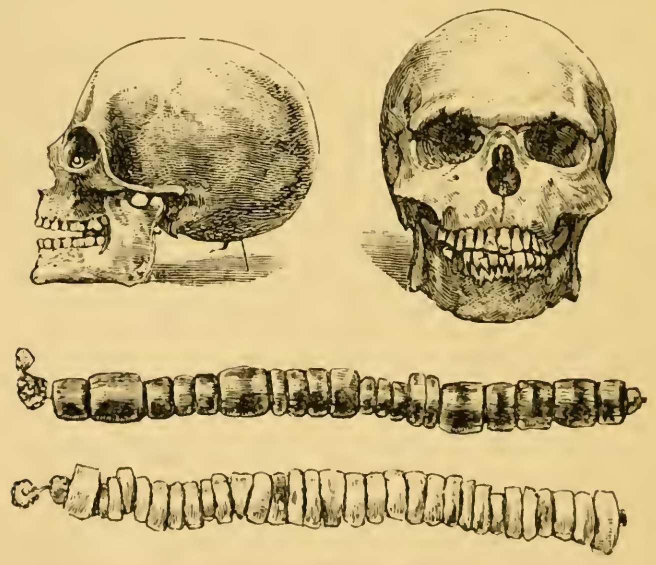


Fig. 15.—Skulls and wampum of Guanches, Canary Islands.

a sudden advance followed by a period of persistent imitation? In short, have we not a right to say that the greatest inventors in the world must have lived before the flood? The study of early post-diluvian arts will enforce this more strongly on us.

The history of the expression of thought by spoken

and written language furnishes another illustration. Archæologists have supposed the existence of speechless men; and it has even been maintained that the absence of the little process of bone in the middle of the lower jaw, to which some of the muscles of the tongue are attached, proves that the Canstadt race of men were *alali*, or speechless. No such inference will, however, hold as to the Cro-Magnon race, since in their jaws these processes occur. But the whole doctrine is baseless. My friend, Professor Wesley Mills, who has given some attention to this subject, informs me that even the loss of the muscles in question would not prevent speech, and that the absence of the bony processes does not necessarily imply the absence of the muscles; and though these men may have had less command over those modulations which depend on the movements of the tongue, they were not necessarily speechless.[1] Yet the nar-

[1] Dr. Mills has kindly given me the following note on this subject:—

(1) Though the muscles attached to the genial tubercles, *viz.*, the *Genio-hyoid* and *Genio-hyo-glossi*, are the most important in the greater movements of the tongue, as, when it is protruded from the mouth, yet many minor movements, such as those concerned in speech, are possible in the absence of the functional activity of these muscles.

(2) The clearest evidence that the tongue itself is not the sole organ of speech, or even an essential organ of speech, is derived from the fact that after the removal of the tongue, as complete as may be, speech is so far possible as to be intelligible, though not perfect, the dentals especially being indistinct; yet there is good utterance. I, myself, many years ago, followed a case of excision of the tongue, and was sur-

rative in Genesis represents man at first as destitute of speech. He was alone, and so had no need of speech; and is introduced to this gift in anticipation of having a partner meet for him. We may imagine the first man altogether silent, or making the woods vocal with inarticulate sounds vaguely expressing his wants, when there was no intelligent ear to hear. His first lesson in speech is in naming the animals (Gen. ii. 19). There is only one possible way in which a solitary and speechless man could do this, and this is by imitating the sounds these creatures made. Thus, the author of Genesis—or, if it be preferred, of that document which combines the names Jahveh and Elohim—commits himself to what is usually called the onomatopoetic origin of language, without, however, excluding the use of natural interjections. I am aware that this theory

prised at the degree of perfection of utterance attained in even a few weeks after the operation. No doubt, certain parts do extra work in the absence of those normally concerned: a principle of very wide application in modern physiology.

(3) But a comparison of even a few lower jaws of man shows that these genial tubercles vary very much in size, etc., in some being but indifferently marked; so that from this, and from the great variety in degrees of development of bony markings for the attachment of muscles, one would perhaps not be justified in inferring the absence of the muscles now attached to these genial tubercles from the absence of the tubercles themselves. So that, altogether, I should myself hesitate to infer that men in whom these tubercles were absent had been without the power of speech, for the various reasons given above.

has been ridiculed by one of the most eminent of living philologists; but I must say that, as a matter of fact, the existence of a vast number of onomatopoetic root words, and the fertility of these as sources of other words, when metaphorically used, commends itself to a naturalist as most certain. To this day the names of animals in all languages betray their origin, and have proved most fruitful roots of language. Can any one doubt that Orev, Rav, Korax, Corvus, Crow, Raven, Corbie, are imitations more or less exact of the voice of the animal? And when we examine ancient languages, we find that a vast number of words—expressing obscurity, darkness, blackness, either physical or moral—have sprung from these words. There is evidence also that this principle of imitation has been transferred from the animals to inanimate things which either make an audible sound or can be made to emit such sound; and not merely names of things but of actions are formed in this way. It has been said, somewhat contemptuously, that primitive man did not speak Hebrew; but Hebrew abounds in such primitive roots, which must have constituted the staple of man's originally small stock of words; and an unusual number of these words appears in the early chapters of Genesis. It is probable that all the words in the first verse of Genesis are onomatopoetic, except *El*, the name of God, which is interjectional, expressing awe or wonder. *Aretz*, "the earth," more especially, is a word indicating the sound of sand or soil, when

it is disturbed by digging or ploughing; and *bara*, "to create," is certainly onomatopoetic. So in later verses, *Hayath*, "animal," from *Haya* or *Hua*, comes from the act of breathing; *Bemah*, "cattle," from their lowing voice; *Ouph*, "fowl," from the sound of wings; *Sheretz*, "swarming animal," from *shar*, "to shear," or divide. The first species of animal mentioned in Genesis, the serpent, has a name, *Nahash* or *Nesh*, taking from its hissing; the second is the raven, whose name, *Orev* or *Horbk*, is taken from its voice. So the dove (*Iona*) has a name derived from its cooing; and a little later in the book we have *Zippor*, "sparrow," from its chirping. It was not without reason, therefore, that this writer represents man as learning speech from the voices of the animals. Children to this day frame their language in the same manner. A very recent case of the formation of a new language is that of the Chinook jargon of the west coast of America. The words of this jargon are largely borrowed from Indian dialects, French, and English—but many are original, and of these a large number are onomatopoetic. The following are examples:—*Tshu*, "to grind"; *He-he* "laughter"; *Hok*, "cough"; *Lip*, "to boil"; *Tik-tik*, "watch"; *Poh*, "to blow"; *Tin-tin*, "bell"; *Took*, "to spit." As to the fertility of these words, none is more so than the curious word *Tum-tum*, "heart," which in various connections serves not only to denote that organ, but "mind," "will," "opinion," "courage," "grief," "affection," etc., so that it be-

comes a perfect dictionary in itself. It is curious that the action of the heart may be represented in different languages by sounds so different as *Tum*, *Leb*, *Kar*, *Cor*; yet all are onomatopoetic, and all most fertile in derivatives and various metaphorical meanings.

As to the time required for the development of language, a new light has recently been thrown on this subject by Hale, in his address before the section of Anthropology of the American Association (1886). In this he has shown that children, not infrequently, have a capacity to invent a language of their own, quite distinct from that of their parents. He has also shown, from American tribes, the probability that this has occurred frequently among them; and thus that no great length of time would be required, under favourable circumstances, to develop a great variety of languages. Mr. Hale's results are so well presented in a review of his address in *Science*,[1] that I quote the statement nearly verbatim:—

"There was once a time when no beings endowed with articulate speech existed on the globe. When such beings appeared, the spread of this human population over the earth would necessarily be gradual. So very slow and gradual, indeed, has it been, that many outlying tracts—Iceland, Madeira, the Azores, the Mauritius, St. Helena, the Falkland Islands, Bounty Island, and others—have only been

[1] August 27th, 1886.

peopled within recent historical times, and some of them during the present century. This diffusion of population would take place in various ways, and under many different impulses,—sometimes as the natural result of increase and overcrowding, sometimes through the dispersion caused by war; frequently from a spirit of adventure, and occasionally by accident, as when a canoe was drifted on an unknown shore. In most instances a considerable party, comprising many families, would emigrate together. Such a party would carry their language with them; and the change of speech which their isolation would produce would be merely a dialectical difference, such as distinguishes the Greek from the Sanscrit, or the Ethiopic from the Arabic. The basis of the language would remain the same. No length of time, so far as can be inferred from the present state of our knowledge, would suffice to disguise the resemblance indicating the common origin of such dialect-languages. But there is another mode in which the spread of population might take place, that would lead in this respect to a very different result. If a single pair, man and wife, should wander off into an uninhabited region, and there, after a few years, both perish, leaving a family of young children to grow up by themselves and frame their own speech, the facts which have been adduced will show that this speech might, and probably would, be an entirely novel language. Its inflections would certainly be different from those

of the parent tongue, because the speech of children under five years of age has commonly no inflections. The great mass of vocables, also, would probably be new. The strong language-making instinct of the younger children would be sufficient to overpower any feeble memory which their older companions might retain of the parental idiom. The baby-talk, the "children's language," would become the mother-tongue of the new community, and of the nation that would spring from it.

"Those who are familiar with the habits of the hunting tribes of America know how common it is for single families to wander off from the main band in this manner,—sometimes following the game, sometimes exiled for offences against the tribal law, sometimes impelled by the all-powerful passion of love, when the man and woman belong to families or clans at deadly feud, or forbidden to intermarry. In these latter cases the object of the fugitives would be to place as wide a space as possible between themselves and their irate kindred. In modern times, when the whole country is occupied, their flight would merely carry them into the territory of another tribe, among whom, if well received, they would quickly be absorbed. But in the primitive period, when a vast uninhabited region stretched before them, it would be easy for them to find some sheltered nook or fruitful valley, in which they might hope to remain secure, and rear their young brood unmolested by human neighbours.

"If, under such circumstances, disease, or the casualties of a hunter's life, should carry off the parents, the survival of the children would, it is evident, depend mainly upon the nature of the climate and the ease with which food could be procured at all seasons of the year. In ancient Europe, after the present climatal conditions were established, it is doubtful if a family of children under ten years of age could have lived through a single winter. We are not, therefore, surprised to find that no more than four or five linguistic stocks are represented in Europe, and that most of these are believed to have been of comparatively late introduction. In California, on the other hand, where the climate is mild and equable beyond example, and where small fruits, roots, and other esculents, abound at all seasons of the year, the aborigines are found to speak languages belonging to no less than nineteen distinct stocks. In Brazil, where the same conditions prevail, more than a hundred stocks, lexically distinct, have been found to exist. A review of other linguistic provinces yields results which strongly confirm the views now presented. A curious ethnological fact which tends in the same direction, is the circumstance, which has been noticed by Major Powell, that, as a general thing, each linguistic family has its own mythology. Of course, when the childish pair or group, in their isolated abode, framed their new language and transmitted it to their descendants, they must neces-

sarily at the same time have framed a new religion for themselves and their posterity; for the religious instinct, like the language-making faculty, is a part of the mental outfit of the human race."

It is true that Mr. Hale is of the opinion that it has been proved that man has existed on the earth for perhaps 200,000 years, and therefore, that for a vast period he must have been speechless; but we have already seen that this difficulty is purely imaginary.

In point of fact, unless we admit that some of the early post-diluvial peoples were survivors of the deluge, independently of Noah, all the present variety of language must have arisen since the deluge; and this question brings before us the remarkable circumstances connected with the Tower of Babel.[1] It would seem that the early colonists of the plain of Shinar, after the deluge, undertook the erection of a tower, probably a temple-tower, like the temple of Bel, subsequently erected in the same region; or like the teocallis, or temple-pyramids, of the Mexicans. Some religious idea—probably that of worship of the heavenly bodies—was no doubt connected with this, but it included also the desire for political unity—of "making to themselves a name." The realization of this idea was prevented, we are told, by the confusion of tongues. The narrator refers this result directly to the Divine justice, and accounts in this way for the diversity of languages

[1] Genesis, chap. xi.

in his own day; but he does not inform us how it came to pass, or if this was by any secondary agency. If it was, we may imagine a multitude, with few forms of expression, brought together in circumstances which required the invention of many new terms, and quarrelling over questions of nomenclature, or we may imagine that the languages of the tribes gathered at Babel had already diverged too far to be re-united. In any case the incident relegates the beginning of diversity of language to post-diluvian times, and is illustrative of the facts adduced by Mr. Hale.

Before leaving this subject I may note that the language and ideas of the antediluvians, as presented to us in Genesis, are of a very primitive character, and that the words used in the speeches attributed to Eve, Cain, and Lamech, for instance, are largely of a widely distributed and very ancient type, and that the ideas in these speeches are appropriate to a very primitive and simple race, to whom trees, animals, and other objects would be embodiments of their highest religious conceptions. I do not need to detain the reader with details bearing upon this, but may refer to what is stated of the trees of knowledge and of life; of sin crouching like a wild beast at Cain's door; and of the distinction made by Lamech between wilful murder, like that of Cain, and homicide in self-defence, like that which he confesses in his own case.

A collateral question here, is the expression of

thought by written or engraved characters. It seems certain that what is called hieroglyphical writing was practised by the Egyptians from the first. The arrow-headed character of Chaldea seems about as old. Both of these may have had their origin in picture writing, and consequently this, at least, must have been antediluvian. In evidence of it we have the so-called tallies, or inscribed bones, from the French caves, and also some curious engraving on bone or ivory, representing historical or personal incidents, and one of which, as given by Lartet and Christy, I have elsewhere commented on as follows:[1] (Fig. 16.)

It represents a man walking with a burden or weapon on his shoulders. Behind him is the sea, indicated by marks representing the waves, and in it swims a large eel. Meeting the man, on the side toward which he is hastening, are two horses, indicated by their heads. The intention may be to commemorate the annual migration of the owner of the inscription from the sea-side, where he subsisted on fish, to the inland plains, where he hunted horses. Or, possibly, it may have been a record of his escape from a destructive inundation. In any case he had arrived at the stage of expressing his ideas by a pictograph; and that his name or tribal designation might not be lost, he has placed on the reverse of his carving (not in our figure) his totem—the head of an aurochs, or wild bull; so that we know

[1] "Fossil Men," page 267.

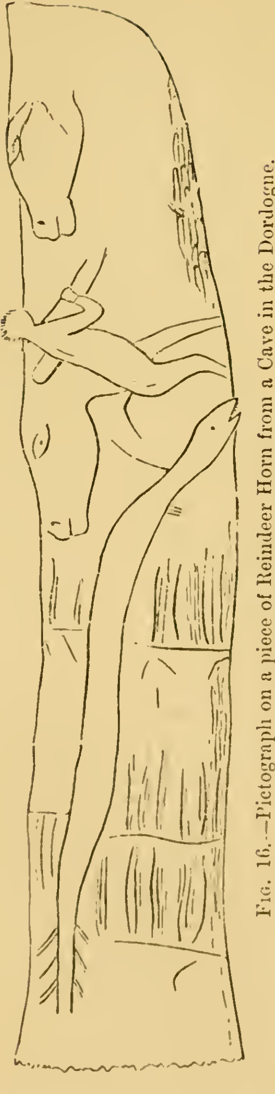


Fig. 16.—Pictograph on a piece of Reindeer Horn from a Cave in the Dordogne. (*After Christie and Lartet.*)

that the family name of this antediluvian sculptor was Urus, Taurus, or Bull, or some primitive form of one of these words.

In connection with Bible literature it seems certain that Abraham must have carried with him, in his migration into Canaan, the Chaldean character; and the Hittite hieroglyphics were probably known in Canaan at least as early. When did the use of the old Hebrew or Phenician alphabet begin? Scribes are mentioned in the narrative of the exodus. Did they write in Egyptian characters or in Hebrew? We have no examples of the Hebrew characters so old, the oldest being the inscription of King Mesha on the "Moabite Stone," as it is called, and the Siloam tunnel inscription, both belonging to the time of the Hebrew kings.

One fact noted in Hebrew history is the only one I know bearing on this. In Josiah's time what was supposed to be the original copy of the Law of Moses was found in the temple, and evidently was in a character legible to Hebrew readers of that time. This would take the Hebrew writing back to the time of Moses. We are thus able, with some probability, to trace alphabetical writing in the very perfect form used by the Hebrews, back to the time of the exodus; and this, I may note, is one of the arts that have since that time not improved but deteriorated, down to our most inconvenient and unscientific English alphabet. The hieroglyphic and syllabic writing we can trace back to the immediate survivors of the deluge. The picture-writing we may carry back to the palæocosmic cave men.

Something has been said above, incidentally, of the religion of primitive man, and though this is quite distinct from his progress in material arts, it may be well to notice it here. That antediluvian man must have had a religion or religions is amply proved by the fact that post-diluvian man everywhere is found to have had strong religious convictions, which could not have been newly born, but must have descended to him from his ancestors. Besides this there is the best evidence of the belief in a future life on the part even of palæocosmic man. Further, even if we were to adopt the dogma of agnostic evolution, and to suppose that the instinct of immortality and the

belief in God were established in some fortuitous manner in a being previously a brute, we could not escape from this conclusion. True, in this case the development of such a superstitious belief would be at once the most inscrutable mystery and the most frightful calamity in the history of our race; but it would be none the less real. Further, it is evident that in any case the idea of God to primitive man must have been very vivid, if imperfectly defined. It would be like the conversion of a Paul or a Bunyan, in bringing man very near to God, even face to face with Him, and realizing His immediate presence in a manner scarcely comprehensible on the part of men whose minds are pre-occupied with a vast variety of ideas of this world. Now this is the representation of primitive man in Eden. He is very near to God, sees and hears Him, feels himself in direct communication with his Maker and Father, even as a little child with an earthly parent.

Again, it is evident that primitive religion must have been a very simple thing. No one can believe that early man possessed any complex system of theology, or of ritual or of priesthood. He was his own high priest, and all nature was his temple, and he had no prescribed code either of morals or ceremonial. This also is the statement of Genesis. The one religious idea is obedience, and the one test of this, abstinence from a fruit presumably hurtful in its effects. This religion is precisely that of a child

turned loose in a garden with an injunction not to taste the fruit of one of its trees.

With the fall all this is changed. New ideas of relation to God, to a spirit of evil, to a future state, to the world, and above all to a Redeemer, come in, and these ideas are obviously radical ones in relation to all the old religions known to us historically. The first great doctrine is that of an evil influence hostile to humanity, and this not to be subdued directly by God, but by a Redeemer born of the woman. Thus, evidently, originates that idea of a new deliverer—a theanthropic saviour, which is the life of all the old religions in various forms. It is little to be wondered at that this idea should ally itself in the minds of men with the original worship of the Creator debased into a nature-worship, or with the deification of the tree of life and its guardian kerubim, and that many heroes and great men should locally have been deified as the expected Redeemer; or even that the old serpent, the spirit of evil, should have been adored or deprecated. Eve herself seems to have regarded her first-born as the promised seed. She calls him Cain (=geneos), because she had got or produced him (Kanah), and she connects him with Jahveh in a manner suited to her undeveloped grammar, and which is scarcely translatable by us. "I have gotten a man—the Jahveh," an identification with God who had given this man, and with the coming man, plain to those who take the words simply as they were

said, but inscrutable to critical minds. Then we have the institution of sacrifice. It is not said how, but it seems that Cain and Abel were already representatives of two types of religion, that of the worship of God as Creator, and that of the coming Redeemer: and we are not surprised afterwards to hear that the Sethites began to invoke the name Jahveh, and that the Cainites continued to be *bene ha elohim.* The two tribes were respectively the Christians and the deists of their time ; and as these faiths degenerated, the one fell into the worship of subordinate redeemers and intercessors, the other into mere nature-worship. It is in these forms that we find them in Chaldea and Egypt at the dawn of history. It was from this degradation that Abraham, the father of the faithful, and the father of all puritans and reformers, extricated the primitive religion when he emigrated from Ur of the Chaldees.

We thus find that the primitive religion, represented in Genesis as that of Adam and Eve, is the root of all religions, however debased; and that, as handed down to us by the Hebrew prophets, and fulfilled in Christ, it is not a new religion, but the development of the old. Nay, more, we can see that when the Kingdom of Christ shall appear in the New Jerusalem, when "God shall dwell with men, and they shall be His people, and God Himself shall be with them,"[1] we shall only return to that

[1] Revelation xxi. 3.

primitive communion of God and man which was in the Garden of the Lord.

All these things—the greatness of man's inventions and the simplicity of his theology before the flood, we can best understand from the study of what we find in the earliest post-diluvian nations; for there can be little doubt that the arts with which the early Egyptians and Chaldeans began their national existence were survivals of the deluge. As we have next to turn to Egypt as a land influencing the Bible and the people of God, we shall have an opportunity, in studying the works of the early Egyptian dynasties, of estimating the value of this kind of evidence, while we shall also be able to appreciate the manner in which these early arts and industries were modified by local conditions, and the light which they cast on subsequent history.

We may conclude this chapter with a summary review of the more important conclusions already reached in this and the previous chapters, and which we may here bring together so as to obtain a more definite idea of their significance, more especially in a scientific point of view.

1. The Bible presents man to us as a distinct creation (Gen. i. 27), and this with special reference to the fact that he was created in the image of God, which, of course, relates rather to his mental and moral constitution than to his bodily frame.

With respect to the first of these, the Bible seems

throughout to affirm the existence in man of a lower (psychical) intelligence, similar to that of the inferior animals, and of a spiritual nature allying him with higher intelligences, and with God Himself. Rightly considered, this places the doctrine of creation in a very firm position. Those who deny it must adopt one of two alternatives. Either they must refuse to admit the evidence in man of any nature higher than that of brutes,—a conclusion which common sense, as well as mental science, must always refuse to admit,—or they must attempt to bridge over the "chasm," as it has been called, which separates the instinctive nature of the animal from the rational and moral nature of man,—an effort confessedly futile.

As to the body of man, the case is different, but still perfectly in harmony with the biblical idea. Man, as to his body, is obviously an animal, of the earth earthy. He is also a member of the province *Vertebrata*, and the class *Mammalia*; but in that class he constitutes not only a distinct species and genus, but even a distinct family, or order. In other words, he is the sole species of his genus, and of his family, or order. He is thus separated by a great gap from all the animals nearest to him; and even if we admit the doctrine, as yet unproved, of the derivation of one species from another in the case of the lower animals, we are unable to supply the "missing links" which would be required to connect man with any group of inferior animals. To us,

therefore, as yet, the human body, and the sensuous nature connected with it, are as much products of creation as they were in the time of Moses. It is to be observed, however, that the Bible does not concern itself with this question, but is content to affirm a direct Divine origin for that higher part of humanity which is implied in the statement that man is "the shadow and likeness of God."

2. Man, according to Genesis, is the latest and culminating product of creation. Without insisting here on the great length of the periods represented by the creative days, which, as I have elsewhere endeavoured to show,[1] the harmony of the different parts of the Bible obliges us to hold, it is certain that the *sheretz*, or "swarmers" of the waters, are stated to have been first introduced, then the higher animals, and, lastly, man. Now, no fact of science is more certainly established than the recency of man in geological time. Not only do we find no trace of his remains in the older geological formations, but we find no remains even of the animals nearest to him; and the conditions of the world in those periods seem to unfit it for the residence of man. If, following the usual geological system, we divide the whole history of the earth into four great periods, extending from the oldest rocks known to us, the Eozoic or Archean, up to the modern, we find remains of man, or his works, only in the latest

[1] "Origin of the World," London; "Recent Discussions of Genesis," *The Expositor*, 1886.

of the four, and in the later part of it. In point of fact, there is no indisputable proof of the presence of man until we reach the early modern period. This is, no doubt, what was to have been expected, on the supposition of the orderly development of the chain of animal life in the long geologic eons; but it is not by any means the only hypothesis that was possible when Genesis was written. A more fanciful cosmologist might have given precedence to man, and might have supposed that the other animals were produced later, and for his benefit, or his injury. This is the view of the sacred writer himself with respect to the local group of animals intended to be in immediate association with the first man. Restricted in this way, the statement of a group of animals created with man in his earliest abode is not contradictory to the order in Genesis first, nor scientifically improbable.

3. The absolute date of the first appearance of man cannot perhaps be fixed within a few years or centuries, either by the biblical chronology or by the science of the earth. It would seem, however, that the Bible limits us to two or three thousand years before the deluge of Noah, while some estimates of the antiquity of man, based on physical changes, on ancient history, or on philology, greatly exceed this limit. If the earliest men were those of the river gravels and caves, men of the mammoth age, or of the Palæolithic or Palæocosmic period, we can form some definite ideas as to their possible

antiquity. They colonized the continents immediately after the elevation of the land from the great subsidence which closed the Pleistocene or glacial period, in what has been called the "continental" period of the post-glacial age, because the new lands then raised out of the sea exceeded in extent those which we have now. We have some measures of the date of this great continental elevation. Many years ago, Sir Charles Lyell used the recession of the falls of Niagara as a chronometer. Estimating their cutting power as equal to one foot per annum, he calculated that the beginning of the process which dates from the post-glacial elevation was about thirty thousand years ago. More recent surveys have, as stated above, shown that the rate is three times as great as that estimated by Lyell, and also that it is probable that a considerable part of the gorge was merely cleaned out by the river since the Pleistocene age. In this way the age of the Niagara gorge becomes reduced to perhaps seven or eight thousand years. Other indications of similar bearing are found both in Europe and America, and lead to the belief that it is physically impossible that man could have colonized the northern hemisphere at an earlier date. These facts render necessary an entire revision of the calculations on the growth of stalagmite in caves, and other uncertain data, which have been held to indicate a greater lapse of time. The value of demands made on other grounds is uncertain and fluctuating.

Egyptian and Assyrian chronology constantly vary as new discoveries are made. Anthropology cannot precisely measure the rapidity of variation in the infancy of mankind; and Hale has recently shown, in the papers noticed above, that American facts respecting language prove that it may vary much more rapidly than has heretofore been supposed.

It is further to be observed, that these demands for long time relate to the post-diluvian period, about which there is a consensus of historical evidences, limiting it to at most 3000 B.C.,[1] and that there is no geological evidence of any considerable change, either physical or vital, within that time.

It is true that announcements have been made from time to time of the discovery of remains indicating the existence of man in deposits as old as the Miocene period; but these alleged facts have broken down on investigation, so that no certainty can be attached to them. Nor have we discovered in the Tertiary formations older than the modern or later Pleistocene any animals nearly related to man as probable ancestors.

To the recency of man we have to add the further fact, that the earliest known men are still members of the human species, not exceeding in their variation the limits presented by the various races of men in the present day. Nor do the bones or the works of the earliest men present any approximation

[1] Sayce, "Hibbert Lectures," 1887, attempts to extend the chronology to over 4000 years; but the data are uncertain.

to those of lower animals. In physical development and cranial capacity, the oldest men are on a par with those who have succeeded them, and, in some respects, superior to the average. There is, however, evidence of the contemporaneous existence of very rude and savage tribes with others of higher culture and development, which is also affirmed of the antediluvians in Genesis.

4. We have next inquired if science can give us any indications of the conditions likely to have accompanied the first appearance of man. Under any hypothesis as to his origin, we may affirm that he was introduced under favourable conditions. Even if, as some evolutionists affect to believe, he was a mere product of the environment acting on some lower animal, this would be absolutely necessary. We cannot imagine man coming into existence already provided with clothing, weapons, implements, and habitation, and already an experienced agriculturist, hunter, or fisherman. If so, his first appearance must have been in some peculiarly favoured spot, where food could be obtained all the year round, and where no artificial warmth or shelter was required. Again, it is evident that such conditions could not have existed at any one time over the whole world. They must have applied merely to some happy vale or elysian island of peace and perennial plenty. Placed in such a region, the earliest men must have at first subsisted on the spontaneous bounty of nature.

Later they would invent arts and implements, discover useful metals and minerals, cultivate the soil, select and improve useful varieties of grains and fruits, domesticate animals, weave garments, and erect buildings, and so enter on the path of mechanical civilization, and assert the mastery of inventive mind in the world. Now, all this, which is merely the reasonable inference from what we know as to the constitution of man, is in accordance with the early biblical narrative, and with the subsequent history of antediluvian man; so that there is absolutely nothing in science which obliges us to renounce our belief in the beautiful story of the "Garden of the Lord," in the fall, and in the antediluvian history.

5. We have already seen that the researches of the late William Kennet Loftus, F.G.S.,—a man equally distinguished as geologist and as archæologist,—have thrown the light of modern science on the much-disputed question of the site of Eden, as described in Genesis. The Shat-el-Arab, the river formed by the union of the Tigris and the Euphrates, receives also two other large rivers, the Kerkhah (the ancient Choaspes) and the Karun (the ancient Pasitigris). Now, if we bear in mind that the manner in which the rivers of Eden are characterized in the second chapter of Genesis shows that the standpoint of the writer in space is on the Euphrates, and that he states Eden to have been to the eastward, while his standpoint in time seems

to be that of Genesis x., when the Cushites were establishing an empire in the Euphratean country, and when the Semitic Havilah dwelt toward "Sephar, a mount in the East," and not in that Arabian seaport which afterward bore its name, we shall find that the four rivers which watered Eden, and which, parting thence, became four heads, must be the Karun, the Kerkhah, the Tigris, and the Euphrates. Further, the objections as to the condition of the Persian Gulf in early historical times fall to the ground when we consider the different conditions of the region in the Palanthropic period.

This locality for Eden conforms also to the known affiliations of the different nations of men, and in some degree even to the speculations of evolutionists. This is obvious from the map prepared by the great German naturalist, Haeckel, to illustrate his "History of Creation," and in which he traces the whole human race back to a spot in the Indian Ocean, where he supposes a continent, now submerged, to have been. If we except this hypothetical continent of "Lemuria," as it was called by Sclater, the affiliation of the main stems of mankind arrived at by Haeckel, entirely on scientific and historical grounds, is very near to that of Genesis,[1] and with this agree,

[1] Haeckel especially states in this connection, and quite independently of the Bible history, in which he does not believe, that neither Europe, Africa, Australia, nor America can, on scientific grounds, be regarded as the "cradle of the human race," and that "most circumstances indicate Southern Asia as the locality in question."

in the main, most of the more eminent anthropologists and geographers. It is true that some theorists have assumed that man began his existence in a half-simian state in those regions in which we now find the lowest types of humanity; but this is, in a scientific point of view, improbable, since we cannot suppose the species to have originated in districts which experience shows to be those least favourable to it.

We have also to notice, with reference to the biblical site of Eden, that while, in modern times, much of it is marshy and insalubrious, it must, in the second continental period of geology, when we may suppose man to have originated, have been more elevated and dry than at present. This removes one of the geographical objections urged against the site of Eden on the lower Euphrates, and shows that the writer of the description in Genesis was aware that he was describing a condition of the district different from that existing in his own time.[1]

6. Of the fall of man, science has naturally little to say. It knows, however, that there is much that is abnormal in the present relations of man and other parts of nature. It can imagine a condition of harmony between man and nature, in which he might be innocent and happy. It knows that,

[1] This fact of the deterioration of the site of Eden in the later antediluvian and early post-diluvian times, which we know on geological grounds must have occurred, probably forms a part, though only a part, of the "cursing of the ground" recorded in Genesis.

like other creatures, he is under law, and that, when he seeks emancipation and to be as a god to himself, he enters on a course of error and suffering. It is also aware that the present is not the best possible condition of the earth, but that in some former times it has enjoyed amenities of climate and an exuberance of vegetable life which it does not now possess. Whatever the cause of this discordance, it is a scientific fact, and so far confirmatory of the historical truth of Genesis, that a great change has come over man in his relations to his Maker and the world around him, and that nothing short of the restoration of the lost harmony can form an effectual remedy.

7. The fall was followed, according to Genesis, by the prevalence of crimes of violence, and by the establishment of distinct and hostile tribes, some of them inventors and artisans, others wandering dwellers in tents. Withal, these antediluvian men were "giants"[1] and "men of renown," strong, courageous and aggressive, warring with each other and with the wild animals around them.

If we identify these ancient antediluvians with the oldest men known to science, the parallelism is somewhat marked. Recent discoveries also suggest the possible equivalency with the historical deluge of the great subsidence which closed the residence of palæocosmic men in Europe and Western

[1] "Nephilim," that is, powerful, formidable men. See the use of the same word for the Anakim in Numbers xiii. 33.

Asia, as well as that of several of the large mammalia. Lenormant and others have shown, as already stated, that the wide acceptance of the traditions of the deluge among all branches of the human family necessitates the belief that, independently of the biblical history, the great event must be received as an historical fact which very deeply impressed itself upon the minds of all the early nations. Now, if the deluge is to be thus accepted, and if a similar great break interrupts the geological history of man, separating extinct races from those which still survive, why may we not correlate the two? If the deluge was misused in the early history of geology, by employing it to account for changes that took place long before the advent of man, this should not cause us to neglect its legitimate uses, with reference to the early human period. It is evident that if this correlation be accepted as probable, it must modify many views now held as to the antiquity of man. In that case, the modern gravels spread over plateaux and in river valleys, far above the reach of the present floods, will be accounted for, not by the ordinary action of the existing streams, but by the abnormal action of currents of water diluvial in their character. Further, since the historical deluge must have been of very limited duration, the physical changes separating the deposits containing the remains of palæocosmic men from those of later date, would in like manner be

accounted for, not by the slow processes imagined by extreme uniformitarians, but by causes of a more abrupt and cataclysmic character.

It is an interesting fact, that those ancient cave men, whose bones testify to the existence of man in Europe before the last physical changes of the post-glacial age, and while many mammals now locally or wholly extinct still lived in Europe, present characters such as we might expect to find at least in the rude nomadic tribes of the antediluvian men. Their large brains, great stature, and strong bones point to just such characters as would befit the giants that were in those days. It is further of interest that, though no relics of civilized antediluvians have yet been discovered, the early appearance of skill in the arts of life in the valleys of the Euphrates and the Nile in post-diluvian times, points to an inheritance of ante-diluvian arts by the early Hamitic or Turanian nations, and is scarcely explicable on any other hypothesis.

8. The occurrence of such a catastrophe as the deluge of Noah is in no respect incomprehensible as a geological phenomenon; and, were we bound to explain it by natural causes, these would not be hard to find. The terms of the narrative in Genesis well accord with a movement of the earth's crust, bringing the waters of the ocean over the land, and, at the same time, producing great atmospheric disturbances. Such movements seem to have occurred

at the close of the post-glacial, or palæocosmic age, and were probably connected with the extinction of the palæocosmic or cave men of Europe, and of the larger land animals their contemporaries; and these movements closed the later continental period of Lyell, and left the land permanently at a lower level than formerly. It is to be observed, also, that the narrative in Genesis does not appear to imply a very sudden catastrophe. There is nothing to prevent us from supposing that the submergence of the land was proceeding during all the period of Noah's preaching, which, we are told, was a hundred and twenty years,[1] and the actual time during which the deluge affected the district occupied by the narrator was more than a year. It is also to be observed that the narrative in Genesis purports to be that of an eye-witness. He notes the going into the ark, the closing of its door, the first floating of the large ship, then its drifting, then the disappearance of visible land, and the minimum depth of fifteen cubits, probably representing the draft of water of the ark. Then we have the abating of the waters, with an intermittent action, "going and returning;" the grounding of the ark, the gradual appearance of surrounding hills, the disappearance of the water, and, finally, the drying of

[1] I understand this to be the obvious meaning of the sentence pronounced in Gen. vi. 3, and not a limitation of man's life to 120 years, which would contradict other statements of the same history.

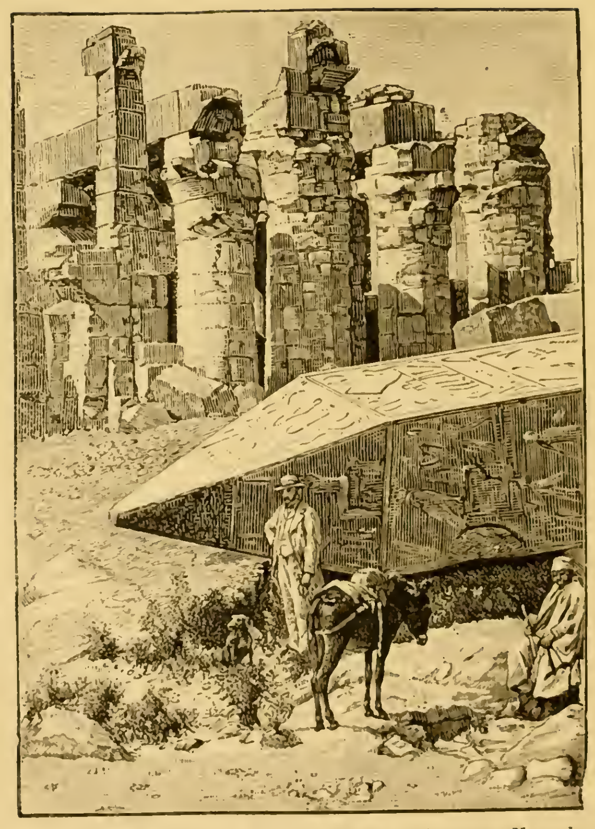
the ground. All this, if historical in any degree, must consist of the notes of an eye-witness; and, if understood in this sense, the narrative can raise no question as to the absolute universality of the catastrophe, since the whole earth of the narrator was simply his visible horizon. This will also remove much of the discussion as to the animals taken in the ark, since these must have been limited to the fauna of the district of the narrator; and, even within this, the lists actually given in Genesis exclude the larger carnivorous animals, though it is true that these are usually present in the toy Noah's arks, from which most persons seem to have derived their ideas of the inmates of Noah's ship. Thus, there would be nothing to prevent our supposing, on the one hand, that some species of animals became altogether extinct, and that the whole faunæ of vast regions, not reached by the deluge, remained intact. It is further curious, that the narrative of the deluge in the Assyrian tablets, like that of Genesis, purports to be the testimony of a witness, and, indeed, of the Assyrian equivalent to Noah himself. The "waters of Noah" are thus coming more and more within the cognizance of geology and archæology; and it is more than probable that other points of contact than those we have noticed may erelong develop themselves.

It is not consistent with the plan of this work to follow further the early history of man in the Pentateuch, except in so far as it may enter incidentally

into the subjects of the following chapters. There are, however, many other points in these old records which commend themselves to the attention of scientific students. Science must, in the future, tend more and more to the vindication of the truth of the early books of the Bible from the attacks of a vexatious verbal criticism. On the other hand, it may derive from these venerable documents many useful hints in aid of its own investigations, as well as invaluable guidance with reference to the moral and social difficulties of the present time, and to the solution of religious doubts.

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Apex of the great prostrate obelisk of Queen Hatasu at Karnak, one of the two largest obelisks known, of red Syene granite. In the background are the ruins of a temple of Nubian sandstone. [From a photograph.]

CHAPTER V.

EGYPTIAN STONES AND THEIR TEACHING.

Nothing is more remarkable in primitive humanity than that exploratory instinct which searches out and utilizes every natural product within reach. We see this in the early discovery of the gold and bedolach and shoham stone of the hills eastward of Eden. We see it in the shells, minerals, and other objects collected in sepulchres and early caves of residence. We see it in the fact that the rudest peoples of modern times have scarcely allowed any plant, animal, or mineral, suitable to their simple needs, to escape their notice. It was the same with those young nations which sprang into existence and grew so rapidly, immediately after the deluge, and whose people brought with them into their new homes the traditional culture of the antediluvian time. The valley of the Nile is perhaps pre-eminent in this respect, and nothing is more striking to a scientific traveller in that country than the variety of material used by its industrious and ingenious people in their works of construction.

In my recent visit to Egypt, my attention was naturally turned to this subject, more especially as I noticed that very inaccurate names are often given to stones and minerals by archæologists. I took every opportunity to obtain specimens of economic stones and minerals, and soon formed a somewhat large collection. I was aided in this by my friends, Dr. Emil Brugsch Bey and Dr. Schweinfurth; and Dr. Bonney, of London, and Dr. Harrington, of Montreal, have been so kind as to contribute valuable lithological determinations. I am also indebted to a paper by Dr. Persifor Frazer on the New York Obelisk,[1] and to another by Professor Rupert Jones, on the marbles and other monumental stones in the British Museum.[2]

The oldest and most durable materials of construction in most countries are the hard crystalline felspathic rocks known as granites and gneisses, of which the Aberdeen granites, so extensively worked in Scotland, constitute an eminent modern example. Rocks of this kind, and mainly of a reddish or flesh colour, occur in Egypt in great force at the first cataract, the ancient Syene, now Assouan, and have been used by the ancient Egyptians from the earliest periods. In the times of the early monarchy, before the Hyksos invasion, that is, before the time of Abraham, these hard stones were worked with as much skill as in any subsequent

[1] "Jour. Am. Inst. Mining Engineers."
[2] "Proc. Geol. Association," vol. viii.

time. A remarkable example is the so-called Temple of the Sphinx at Gizeh, attributed to Kephren, the builder of the Second Pyramid, and a monarch of the fourth dynasty. This temple, preserved by having been buried in the drift sand of the desert, is constructed of immense squared stones of red granite, beautifully fitted and jointed ; and Kephren's pyramid was cased with the same costly stone. A still earlier building, the Great Pyramid, though constructed of limestone, has its principal interior chamber built of this red granite, with the stones fitted in the nicest manner, and arranged so as to resist effectually the pressure of the superincumbent mass. The last of the great obelisks which adorned the Temple of the Sun at Heliopolis, dates from the reign of Usertesen I., of the twelfth dynasty, and is the oldest obelisk now standing in Egypt. It was an old monument in the time of Joseph. Later obelisks from the same temple are those now in the New York Park and the Thames Embankment, and which are said at this moment to be the largest quarried stones in these countries, though they were quarried, sculptured, and set up as early as the time of Joseph, and had later inscriptions added to them in honour of Rameses II., the Pharaoh of the Hebrew oppression. But these obelisks are inferior in size to those set up by the great queen Hatasu, the elder sister and predecessor of Thothmes III., which are eighty feet in height, and one of which still stands in all its majesty. The

other has fallen, and lies in several pieces on the ground, enabling the traveller to see its beautifully polished apex or pyramidion, ornamented with figures of the kneeling queen presenting offerings to the spirit of her deceased father, represented as a god—perhaps one of the finest and boldest pieces of granite-cutting in the world.[1] It is interesting to note that this Hatasu, who built a magnificent tomb for herself at Deir el Bahari, opposite Karnak, has so far been more fortunate than her contemporaries in having it preserved inviolate, while it has also served as a refuge in times of danger to the mummies of several later royal personages, including the great Rameses himself. The mummy of Hatasu has, however, as yet not been found, and I have no doubt that it is placed in some secret receptacle never yet revealed [2] to greedy Arab or prying antiquary.

The two greatest granite statues in Egypt, or in the world, are those of Rameses II., at Tanis, whose fragments, according to Mr. Flinders Petrie, show that it must have been eighty feet in height, and the prostrate statue of the same king, at the Rames-

[1] See cut facing this chapter. In an inscription on the obelisks of Hatasu they are said to have been gilded, and the pyramidions terminated with pure gold; and the almost incredible statement is made, if it has been correctly read, that the stones were taken from the quarry, set up, and sculptured in the space of seven months. The name of the artist of these magnificent monuments is said to have been Semnut.

[2] May it remain till that resurrection day to which she, with the faith of her people, no doubt looked forward!

seum in Thebes, which has been sixty feet high. The latest of the great granite shafts brought from Syene is that of the pillar in honour of the emperor Diocletian, known as Pompey's Pillar, and now standing at Alexandria. Its shaft is seventy-three feet in length. Another great stone, intended for an obelisk, and of unknown date, lies quarried out, but unremoved, in the quarry at Assouan. It is ninety-five feet long, and eleven and a half feet wide at the base.[1]

One of my specimens is a portion of a pedestal or a tablet, with the name of Seti I., father of Rameses II. It is made of a coarse dark red and grey granite, with large crystals of red felspar.[2] The

[1] The beautiful figure of Rameses II., seated between two deities, and the great historical stela of the same king, found on the site of Pithom, and now in the public square at Ismalia, are of this red granite, and are of special interest from their probable connection with the labour of the Hebrew bondsmen.

[2] This red granite of Syene, sometimes called rose granite, or red oriental granite, is a hornblendic granite, consisting of red orthoclase felspar, whitish quartz, and black hornblende. By the occurrence of large felspar crystals, the mass sometimes becomes porphyritic, and resembles the spotted granite of Shap, in Westmoreland, though of a lighter colour. Sometimes it is so poor in quartz, that it becomes a syenite, in the modern German acceptation of the term. In point of fact, the true syenite, or rock of Syene, is a syenitic granite, but certain German lithologists have feloniously attempted to rob it of this name. A specimen in my collection, from the ruined temple of the Second Pyramid, has a red and white felspar, a little quartz and black hornblende, and also contains a few scales of black mica, and a little pyrite.

hieroglyphics are deeply and remarkably clearly cut, and with square edges. Circular figures have apparently been sunk with a hollow drill, armed, probably, with emery or diamond. This kind of cutting explains many of the great works of the ancient Egyptians in hard stone. Mr. Petrie was the first to inform us of this fact, and I now possess cores of hard stones collected by him. The use of a hollow reed, armed with sand, is a contrivance of many rude peoples, and possibly antediluvian. The Egyptians had perfected the instrument into the likeness of the modern diamond drill, and with this they bored into these great granite stones, cutting them into holes, and then breaking out the cores and intervening spaces. On the wall of the Boulak Museum I saw a slab of hard stone which had been treated in this way, and left in an unfinished state, showing plainly the method by which hieroglyphics had been cut in the finished portions. (See Fig. 17, p. 276.)

The colossal statue of Rameses, at Thebes, is of a coarse variety, tending to gneiss, since it shows a laminated structure; and the same is the case with some other statues of the same king at Luxor and Karnak. It is to be remarked here, that the gneiss is often a more compact and durable stone than the granite, except that it tends more readily to split along the planes of lamination, and sometimes presents irregular dark bands. In some of the older structures at Gizeh, a porphyritic gneiss is employed,

which has two kinds of felspar, white and pink.[1] The red syenite is probably the *Lithos Æthiopikos* of Herodotus, and the *Syenites lapis* of Pliny.

Another frequent stone in Egyptian architecture and sculpture is a black granite, often confounded with diorite and basalt. We are most familiar with white and grey granites, or those of a reddish hue, but there are varieties of the rock of so dark a colour that they may be called black, though when polished they are usually of a very dark grey. They contain the ingredients of ordinary granite, except that the dark-coloured hornblende is in large excess.[2] I obtained specimens of this rock from a doorway in one of the oldest temples at Karnak, and from the *débris* of the perished temple of the Second Pyramid at Gizeh, also from a sarcophagus at Thebes; and some, at least, of the remarkable statues of the cat-headed goddess Pasht, or Bast, in her temple at Karnak, are of this stone.[3] A similar stone occurs in one of the old sarcophagi at Sakkâra. A figure of Nectanebo I. and a hawk from Pithom, now in the British Museum, are of black granite.

The black and white spotted rock, consisting of black hornblende and white lime felspar, properly

[1] Oligoclase and microline. In the paper above referred to will be found a good description of the minerals of the New York obelisk, by Professor Frazer.

[2] Quartz, felspar, and hornblende, or mica.

[3] Dr. Harrington states that it consists of quartz, orthoclase, oligoclase, and a little microline, hornblende, biotite, magnetite, and sphene.

named diorite, was a favourite material for Egyptian sculpture. Far back in the Stone period this rock must have been known to the Egyptians, as to all other primitive peoples, as the best material, next to jade, for stone hatchets, chisels, and hammers. A fragment of a hammer of this material occurs in my collection from the old cavern at Nahr el-Kelb, and every collection of North American stone implements contains chisels and axes of diorite. Perhaps this primitive use directed early attention to it, or perhaps its capacity to take a high polish, its dark colour, and its extreme durability, may have tended in this direction. In any case, though apparently not used for obelisks, it is one of the most common materials of sphinxes, and statues of gods and kings, and, as Mr. Petrie's excavations at Naukratis have shown, was also largely used for platters, trays, and similar utensils. More especially, a variety found at Assouan, and which has large white blotches on a black ground, was a very favourite material. At Assouan this rock, which occurs in dykes or great seams in the gneiss, weathers out on the decay of the containing rock, and stands out in relief in large masses, almost isolated. Of these the Egyptians seem to have taken advantage, because of their accessibility, and possibly also, because the fact of their thus weathering out testified to their extreme durability. I have numerous specimens from broken statues and statuettes; some of these are ordinary diorite, others the spotted variety above mentioned,

others a black variety, almost wholly hornblendic, and some in which the hornblende has a dark green hue. According to Jones, the celebrated Rosetta stone is a diorite, and the great scarabæus and several sarcophagi in the British Museum are of the same material. He thinks that the Basanites of Pliny was a diorite, but it would rather seem to have been the diabase referred to farther on. The two Pithom sphinxes now at Ismalia are of diorite, as also the great sphinx of the shepherd kings, and the statue of the "fish-offerers" from Zoan, now in the Boulak Museum.

Jones also notices the remarkable statue of Rameses II. in the British Museum, the upper part of which only remains; but this, though in one piece, consists of two kinds of stone. Below, it is of the white-spotted diorite, above, it is of red granite, and the stone must have been obtained from the junction of a diorite vein with a mass or dyke of granite.

The manner in which the Egyptians quarried, removed, and worked these gigantic, refractory, and very heavy stones has long attracted inquiry and attention. The granite obelisk now lying in the quarry at Assouan shows that the method employed was to cut the two outer faces of the great prism, and then to disengage the mass by notching it behind, and inserting wedges, subsequently soaked with water. An attempt has been made at a later date to cut up this obelisk into blocks by cross grooves,

on which fires would probably have been built, and then suddenly quenched with water, so as to crack the stone; but the intention was not carried out. If many skilled workmen were available, the quarrying of one of these stones need not have occupied much time. The removal of the disengaged block from the quarry was effected by means of a tramway and rollers, as represented in figures copied by Wilkinson. The motive power was that of men pulling on ropes. Brought to the river's bank, the stone was probably placed on a raft or barge at low Nile, and when floated at the time of the inundation, was carried to its distant place by water, and floated as high as the inundation would permit. The dressing and polishing of these stones was a work of great labour, and must have been done with tools of hard bronze or steel, and with rubbers of sandstone. The incising of hieroglyphics was, as Petrie has shown, accomplished with hollow drills of metal, armed with emery or diamond. The more quartzose varieties of granite must have taxed the tools and the patience of the sculptors severely; but, as we shall find, the Egyptians sculptured even quartzite itself.

Another dark-coloured stone profusely employed by the Egyptians, especially for smaller objects, is a nearly black or dark-greenish substance, showing a slight play of colours in spots when polished, and weathering in places to a rusty hue. It is a fine-grained diabase or dolerite, with detached crystals

of olivine, and occasional cleavable crystals of lime felspar.[1] Chips and fragments of it, sometimes with polished surfaces, abound on most of the sites in Egypt. I have a painter's pallet in this stone, and two scarabs, one of the sacred eyes used as charms, and some large beads, and there are a polisher, perforated disc, and other objects, in a small collection from Naukratis, presented to the Museum of McGill University by the Egypt Exploration Fund. This stone has a dingy appearance, and I do not know why it was so favoured, except, perhaps, for the greenish colour and lustrous appearance of the olivine grains and the play of colour in the felspar. Neither of these appearances is, however, conspicuous, except under a bright light, and in recently polished specimens. A rock similar to this occurs in the Upper (possibly Huronian) series at Assouan; but I did not see any place there where it had been quarried. It no doubt occurs in the Arabian ridge east of the Nile, and may possibly be one of the varieties of the more modern volcanic rocks occurring in Lower Egypt, and described by Arzruni from specimens collected by Schweinfurth. I have unfortunately no specimens of these rocks, which occur at Abu-zabel. The prevalent rock is, however, described as an olivine-dolerite, in terms which might well apply to the kind of stone in question.

Next to this I would place certain rocks which

[1] It might be otherwise called a picrolite, or an olivine diorite.

are usually called basalt, but some of which seem really to be hardened ash-rocks of volcanic origin, or altered sandstones. They were no doubt quarried in the hills east of the Nile. I have a small vase in this stone, probably an ash-rock; and the sarcophagus of one of the sacred bulls at Sakkâra appeared to be of similar material. In the tomb called that of Unas, at the same place, are fragments of a sarcophagus of similar stone. A fragment of a sacrificial tablet from Thebes, in my collection, is of a greenish altered sandstone, having some resemblance to the stones mentioned above. Fragments of a compact basaltic-looking stone occur on the pyramid plateau; and Dr. Schweinfurth has found masses of rock of this kind in the hills toward the Red Sea, where it has been quarried. True basalt is, however, not common in Egyptian sculptures, though it has been the custom to call all dark-coloured rocks by this name.

A geological visitor to the Boulak Museum has his attention at once arrested by the beautiful statue of Kephren, the builder of the Second Pyramid. It is a fine portrait statue, in the best style of early Egyptian art, when it was still natural, and before it had entered on its later conventional stage. It is one of several such statues found in fragments in the red granite temple of the Sphinx, to which reference has already been made; and though of very great antiquity, its polish is as perfect as if done yesterday (Fig. 17). The stone is usually called diorite in the

descriptions, but is really an anorthosite gneiss of the same description with that which occurs abundantly in the Upper Laurentian of Canada, and I recognised



Fig. 17.—Statue of Kephren, or Kafra, the Builder of the Second Pyramid, in Anorthosite Gneiss. (Boulak Museum.)

it at once as a familiar rock. It has, at first sight, the aspect of a dark grey marble, with blackish veins running through it; but its lustre is higher

than that of marble, and its hardness much greater; and the apparent veins are really the lines of bedding, marked by dark streaks of hornblendic matter.[1] The rock itself is essentially a lime felspar, with a banded or gneissose structure. When polished, it has a fine translucent appearance and a very high lustre, akin to that of moonstone. I did not see this rock in place, but was informed that it exists in the mountains east of the Nile, where it no doubt indicates the existence of a formation of the Upper Laurentian age. I am not aware that this beautiful rock has been worked in more modern times; but the sculptors of Kephren, in his far-back time, anterior to that of Abraham, had the audacity to execute in it no less than nine statues of this king, for his temple at Gizeh. The material is a hard and obdurate one, but it has vindicated the selection by its unique beauty and great durability. I have seen small ornamental articles of the same stone, one being a knob or button presented to me by Brugsch Bey, but I do not know their dates.

Serpentine was a favourite material with many ancient nations, owing to its green colour, its fine lustre when polished, and the ease of working the softer varieties. I did not see it in place, but it is a natural accompaniment of such rocks as those of Assouan. I have in my collection a fragment of a ushebti, a little mummy-like figure buried with the

[1] The marks seen on the right arm of the statue (see figure), represent these lines.

dead as a servant in the spirit-world, in this material; also scarabs and vases, and in the collection from Naukratis, already referred to, are platters of a coarse greenish serpentine. Many figures and other objects of this material may be seen in the Boulak Museum. Green serpentine was one of the stones included by the ancients as varieties of emerald. The colour was a sacred one, and it is not unlikely that the green glaze which covers many of the little earthen ushebti and scarabs was intended to imitate such stones.

Talcose schist, allied to the potstone of America, and chlorite schist of a very dark green colour, were very much used for small and cheap figures of deities, etc. The material, being soft, readily lent itself to purposes of this kind, and though easily scratched, it is susceptible of a good polish. Allied to these stones are various kinds of slates, green, grey, and purple, which were extensively cut and polished for a great variety of uses. The talcose and chloritic stones appear to have been much used for moulds, wherein to cast metallic objects, as rings, balls, etc., a use for which their softness and resistance to heat well fits them. Many objects of this kind occur in the Naukratis collections. In the same collections occurs a curious instance of perseverance in the polishing of a slab of chlorite schist, holding intensely hard crystals of magnetite; but the industrious lapidary has smoothed the stone, regardless of this inconvenient hardness of a portion

of it. In these Naukratis collections occur fragments of the beautiful bright green chromiferous mica schist, only known to me elsewhere from localities in the Tyrol and in the state of Maine. I have not seen or heard of it as occurring in place in Egypt, but it might occur in the Arabian chain; nor do I know to what use it was applied, unless, perhaps, to be inlaid, on account of its brilliancy, in mosaics or ornamental stucco-work.

I was not so fortunate as to see *in situ* the Egyptian red porphyry so extensively used in the Roman period. I obtained, however, a small disc or button of the variety with black ground and white spots, caused by small crystals of white felspar. Nor did I obtain any specimen of the famous green breccia, of which the sarcophagus of Nectanebo I. in the British Museum is made, and which is found near Kosseir, on the Red Sea, belonging probably to the Huronian or Cambrian series. It is an epitome of the older lithology of Egypt, containing, according to Newbold, fragments of gneiss, diorite, porphyry, slate, serpentine, green felspar, and marble, all compacted together by a greenish or purplish, slightly calcareous cement.

Another very hard stone, much used by the Egyptians, is the red, brown, and white quartzite, or quartz rock, which is found in the hill of Jebel Ahmar, or the Red Hill, near Cairo. This hill consists of a stratified sandstone, more or less tinged with oxide of iron, and resting on the Eocene limestone, itself

being of Miocene age. It is therefore, geologically speaking, not of ancient date. It is the matrix of the celebrated petrified forest, the silicified trees of which, washed out of the sandstone, lie loose on the surface of the desert; but may also be seen in place in some parts of Jebel Ahmar. The remarkable feature of this rock is, that since its deposition, siliceous springs have poured through it, and have hardened portions of the sandstone by deposit of flinty matter between the grains, so that it becomes a perfect quartzite, resembling some of the oldest rocks of that description. In process of time, and more especially in the Pleistocene age, when much of Egypt was under water, and on its emergence was deluged with rain, the softer part of the sandstone has been washed away, leaving only the fossil trees. The harder part remains in Jebel Ahmar and some similar hills. This hard stone has been so extensively quarried in ancient times, that the sides of the hill are a mass of stone chips; and it is still used for millstones, and also for macadamizing the newer streets of Cairo. But the uses made of it by the ancient Egyptians were multiform, and some of them almost incredible. This stone must have attracted the attention of the Egyptians at a very early period. Though flint available for knives and arrow-heads abounds in the limestones of Egypt, and has been used throughout the whole course of Egyptian history, up to the present day, and though diorite, fit for the formation of stone axes and

chisels, is also abundant in Upper Egypt, quartzite like that of Jebel Ahmar must have been very valuable to prehistoric man as a material for battle-axes, hoes, harrow-teeth and spear-heads, stone hammers and drill-sockets, specimens of some of which exist in collections. I have in the collections of the Egypt Exploration Fund, from Naukratis, a

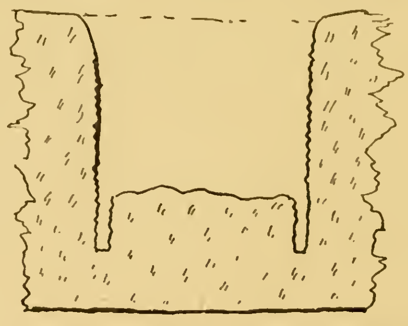


FIG. 18.—Section of drilled Pivot-hole, Gizeh, after Petrie.

disc-shaped drill-socket with the round hole in its centre polished to the last degree of smoothness, and a hammer or polisher made of the same stone. In somewhat later times it commended itself to the Egyptians as the most durable stone for some of their larger works. My first acquaintance with it in this aspect was in the collection of the late Dr. Douglas, of Quebec, where, many years ago, I saw an oblong stela, or monumental tablet of quartzite, with an inscription deeply incised on it. I remarked at the time, that the sculptor must have consulted durability and indestructibility without regard to

labour or expense; but I was not then aware of the far greater extent of work of this kind in Egypt itself. In the Boulak Museum are two tables of offerings of this stone, of the white or light grey variety. They are flat and square, almost four feet in width, and six inches thick. The edges are inscribed with hieroglyphics, and the tops are wrought into a series of perfectly formed and beautifully worked circular bowls, to hold the offerings of worshippers. They are believed to belong to one of the older periods of Egyptian art, and are astonishing monuments of the skill and patience of the early workmen. They are also the highest artistic realization of those flat slabs, with cavities for offerings, which constitute the rude altars of the hills of Palestine, and of so many other countries.

In front of one of those great propyla, or gateways, which adorn the temples of Karnak, on the side towards Luxor, I noticed the lower half of a sitting statue of this stone, which must, when entire, have been twenty to thirty feet in height. It was composed of a single block of the Jebel Ahmar quartzite, or a stone of similar quality, of a light brown colour, and with lines of flint pebbles passing diagonally across the great body. I had not seen any notice of the figure in the guide-books, and was struck with the fact, unexampled, I suppose, elsewhere, of such a figure executed in a stone as hard as agate. On its pedestal was a royal cartouche, which I suppose to be that of Thothmes II. The upper part of the

statue was entirely gone, and I feel sure that nothing short of intentional violence could have prevented it from enduring for ever. A figure of such material would be everlasting, not only in the climate of Egypt, but in any climate in the world. The statue referred to had been one of six of similar size, sitting in front of this propylon. The first, on the left hand, on approaching from the south, was of finely granular white limestone or marble with crystalline veins. The second was also limestone, a hard, compact, white variety, showing, under the microscope, oolitic grains cemented by calcite. The third is the quartzite statue already referred to. The fourth is of compact limestone, like the second, but without the oolitic structure. The fifth was wanting; but, judging from the fragments scattered around, had been of quartzite like the third. The sixth was also wanting, but chips scattered around indicated that it had been of Assouan granite. It is likely that the quartzite and granite statues had been destroyed to make millstones, while the less useful limestone had been spared. It would thus appear that the six statues placed in front of this gateway had been of different materials, derived from quarries in various places between Assouan and Cairo, and two of them were of a quartzite which would entirely defy the art of the modern sculptor, unless he were to work, like his predecessor in Egypt, with the diamond drill.

Among the remains excavated from the temple

erected by Rameses II., at Pithom, and now at Ismalia, is a portion of a monolithic shrine made of this rock. The material has not been of the most uniform quality or colour, and it has been injured by weathering, and broken; but as it stands, it is a remarkable work. In form it is a little room or chamber about six feet long, five feet wide, and four feet high, with the walls, which have been covered with hieroglyphics, about six inches thick. In the centre are the remains of a sphinx, like a dog sitting in a kennel, and this sphinx is itself a portion of the rock left in excavating the shrine. The stone is so cut that the bedding is vertical, and it must have been hollowed out by the drill. It was, no doubt, dedicated to the sphinx or guardian kerub of the place; and as it is co-eval with the oppression of the Hebrews, and from one of the store cities which they erected for Pharaoh, the question arises whether this somewhat unusual symbolism may have been intended for the edification of the Hebrews, as representing one of their religious symbols. Mr. Petrie describes a shrine at Zoan, or Tanis, which seems to have been similar to this; but I have not seen any specimen of its material.

Had the Egyptians been limited to the hard stones above referred to, with all their industry and skill, they would have been unable to carry out their greater architectural works; but they had unlimited supplies of easily worked material in the Nubian sandstones and the Eocene and cretaceous

limestones of the Nile valley. The most important quarries of the sandstone are at the gorge of Silsilis, or Selsileh, where the Nile flows in a narrow channel between cliffs of this rock, and very extensive quarrying operations have been carried on, and rock temples excavated. The quarries at this place show the very careful manner in which the Egyptians cut out their great blocks by means of chisels and wedges, leaving the quarry face in very good condition, and wasting very little material. The same methods were employed in the limestone quarries at Turra, and were in use in Asia also, as they appear in the quarries of the kings under the city of Jerusalem. Beyond Silsilis, the sandstone has been opened at various places on the Upper Nile. I saw remains of old quarries on the island of Biggeh, near Philæ; and behind Assouan there are quarries in a ledge of this sandstone where drums for columns have been cut out in such a manner as to leave semi-cylindrical recesses in the quarry face. Farther up, the great temple of Abou Simbel is excavated in this rock.

The sandstone of Silsilis, which is the so-called Nubian sandstone, is in thick beds separated by layers of shale, and affords good blocks of a buff or grey colour, sometimes nearly white, or with a tinge of reddish. It is easily cut and coarse grained, and in an extreme climate much of it would be very perishable. Even in Egypt, when exposed to moisture, it decays somewhat rapidly. It is, however,

an admirable building stone, and nearly all the great temples in Upper Egypt are constructed of it. It suits very well for a bold and vigorous style of sculpture, and it is well adapted to the large hieroglyphics and gigantic battle-scenes on the propyla and walls of temples, as well as to the building of such great columns as those of Karnak, Dendara, Esneh, and Kom Ombos. When finer decoration and brighter colouring were desired in the interior of temples, it was coated over with a thin, smooth surface of gypsum, giving it the effect of white marble, and on this, coloured figures were painted. At Kom Ombos I saw a slab, with raised hieroglyphics cut in a grey layer on a reddish ground, having the effect of a coarse cameo; but I do not know if this was intentional. The two great statues of Amunoph, on the plain of Thebes, the Colossi *par excellence*, and one of which was the vocal Memnon,—a distinction probably due to fissures in the stone,—are of this material, and, with the gigantic figures at Abou Simbel, furnish the principal examples of its use in statuary.

Limestone constitutes the mass of all the cliffs fronting the valley of the Lower Nile. In it were excavated the rock-cut tombs of Beni Hassan, Sakkâra, Assiout, Thebes, and many other places. Of it were constructed the pyramids of Gizeh, and, to a large extent, the temples of Abydos, and probably those at Memphis and other ancient cities of Lower Egypt. It is of various degrees of hardness

and texture, and of prevailing light colour, often pure white. It is, in the main, an organic limestone composed of shells and tests of marine animals, and fragments of these. The stepped pyramid of Sakkâra, supposed to be the oldest in Lower Egypt, is built of a light-brown coarse limestone from the vicinity. The material of the great pyramids of Gizeh, with the exception of their outer casing, is the nummulitic limestone of that part of the Nile cliffs, some of it containing quantities of entire discs of nummulites and other fossils. The outer casing of the Great Pyramid was of a beautifully fine white limestone, from the quarries of Turra, on the opposite bank of the river. With this also the finer buildings of old Memphis were constructed, and it is still used in Cairo. This limestone has the appearance of a hardened chalk, and is easily worked and sawn. Under the microscope it shows an infinity of minute microscopic shells of *Foraminifera*. A very large proportion of the sculptures and inscriptions in the temples and tombs are cut in this white limestone. In the case of the tombs, they are often engraved on the solid rock itself; and in the case of temples, on slabs lining the walls, and very neatly fitted to each other. In the excavation of tombs, the beds of pure white limestone were carefully selected, and in like manner the best layers were followed in the quarries. After the inscriptions or figures were cut on the walls, they were tinted with bright colours. These colours, as we saw them

at Abydos, and in the Theban tombs and elsewhere, are red ochre, yellow ochre, a copper blue and green, and white, the latter apparently gypsum. All these colours are unchangeable by time, durability being evidently a main object with these old people. The medium employed was evidently not size, but apparently gypsum, applied rapidly, before it had time to set. If not, the colour, in a very fine state of division, was merely mixed with water and applied to a thin film of gypsum previously laid on the stone. This was certainly the method used, as already mentioned, in colouring sandstone interiors. One of the finest extant examples of work in the white limestone, is that of the tomb of Ti, a wealthy country gentleman of the old kingdom. The style and taste of the sculptures in this tomb, which is of very early date, are superior to those even in the tombs of the kings at Thebes, though on a less extensive scale. The celebrated sphinx of Gizeh is merely a mass of limestone left when the rest of the bed was removed, and shaped with wonderful art into that monster, whose grave, sweet countenance still retains some expression, even after wanton disfigurement, and which was the guardian cherub of the cemetery of Memphis.

One of the most interesting materials employed in Egypt, is the oriental alabaster, one of the stones called onyx by the Romans, though not that to which the name is now applied. It has, however been not inappropriately called "onyx marble."

Egypt was in ancient times celebrated for this stone, which may be obtained in considerable quantity at several points on the Nile. It is a carbonate of lime, deposited in successive layers, often differing in colour and texture, in the same manner with the stalagmite and stalactite, or "congealed water" of caverns in limestone rock. Large veins of it occur in the Eocene limestones of Egypt, and have been worked from the earliest times. At Gizeh, the magnificent granite temple of Kephren, already mentioned, was lined with this stone in the early age of the pyramid-building kings; and the interior decoration of the mosque of Mehemet Ali, in the citadel of Cairo, is of the same stone. Some of the very old tombs in the Memphite cemetery at Sakkâra are lined with alabaster, or partially so lined. A curious example of the latter may be seen in the tomb called that of Unas. The inner sepulchral chamber of this tomb is lined with slabs of alabaster. The work is then continued in common limestone, and the entrance of the tomb is lined with the stronger and more enduring red granite. At Abydos are the remains of a magnificent monolithic shrine of this stone; and at Karnak a similar shrine is built of alabaster slabs, some of them twenty feet in length. In this and other cases one is astonished that so fine work and material should be lavished on places enshrouded in darkness; and the question is raised, but cannot be answered,—What means of illumination had the

ancient Egyptians, beyond the smoky oil lamps and torches, which would scarcely suffice adequately to illuminate the interior of tombs and temples, and would soon have destroyed their beautiful workmanship?

Alabaster was largely used for vases, flasks, and unguent pots, of which great numbers are found

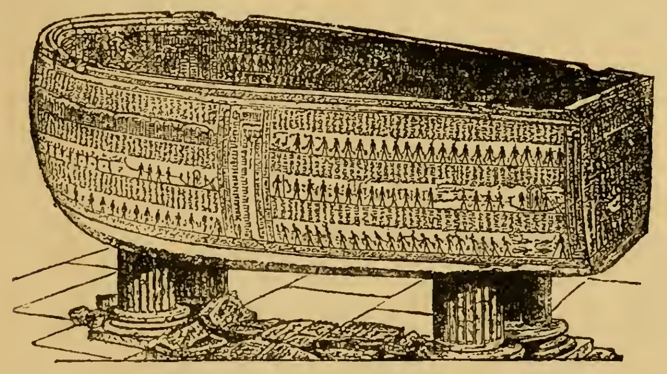


FIG. 19.—Alabaster Sarcophagus of Seti I., now in the Soane Museum, London.

in Egyptian tombs. One derivation of the name is from these handleless vases;[1] but it is more likely that the word is Egyptian, and possibly the name of a place where the stone was quarried.

The finest work in Egyptian alabaster that I have seen is the sarcophagus of Seti I., father of Rameses II., found in his tomb in the "valley of the kings," by Belzoni, and now in Sir John Soane's Museum, in London. It is 9 ft. 4 in. in length, 3 ft. 8 in. wide,

[1] Α, "not," and λαβη, "a handle."

and from 2 ft. 8 in. to 2 ft. 3 in. deep; and is hollowed out of a single block so delicately that its general thickness is only 2½ inches, and that a lamp placed within shines through the translucent sides. On the bottom of the coffin is a figure of Netpe, or Athor, the mother goddess, with arms extended to receive the body of the king; and the whole surface is covered with inscriptions and processional figures representing the liturgy of the dead. The lid was of similar character, but has been broken to pieces. By a singular combination of accidents, the mummy of this great king—which had been transferred by its guardian priests, for greater security, to Deir el Bahari—is now in the Boulak Museum; the noble sarcophagus prepared for it is in London; and his vast and beautifully decorated tomb stands open for the inspection of travellers in the "valley ot the kings."

The gypseous or soft alabaster is an entirely different stone from that above referred to, but was used by the Egyptians especially in later times and for small objects. Common gypsum occurs in various places in Egypt, and is apparently a modern deposit. A noted locality is at the base of the hills between Cairo and Helouan, where it is now quarried, and carried on the backs of camels to the railway, and thence to Cairo. It is, I presume, a deposit due to the action on the limestone of the same sulphurous waters which supply the Helouan baths. The ancient Egyptians well knew the properties and uses

of gypsum, and employed it for cements, castings, and plastering the interiors of buildings and the surfaces of walls of crude brick. Stucco work on a large scale was not, however, much to the taste of the more ancient people of Kemi, and is more common in the Greek and later periods.

A pure, transparent, cleavable calcite, like Iceland spa, occurs sparingly in the Egyptian limestones; and I have beads and small ornaments executed in this stone, which, when recently polished, would resemble rock crystal, but is more easily scratched, and liable to break along the planes of cleavage.

Fine grey clays and talcose clays, soft or indurated, are found in various places in the Nile valley, and are used as cement, fullers' earth, and for pottery, and the manufacture of sham scarabs, in making which certain Arabs near Thebes are adepts. The manufacture of coarse pottery and of pottery jars has gone on from time immemorial in Egypt, and the *débris* of the water jars of the workmen at the pyramids before the time of Abraham, and those used to-day, are not materially different. There are, however, local differences; and some localities, as Ballarieh and Keneh, are celebrated for water jars, of which immense boat-loads are sent down the river from these places. The art of making fine porcelain seems to have been unknown in old Egypt, but objects moulded of a white sandy kaolin were covered with coloured glazes of great hardness and durability, and beautifully coloured. In very ancient

times the curious figures like little mummies, called ushebti, or servants, were formed in this way, and covered with a greenish or bluish glaze, coloured with copper, and absolutely indestructible. These figures are often covered with black hieroglyphics, done in oxide of manganese. The ushebti were probably a survival of the old custom of immolating slaves on the tombs of their masters, that they might have service in the world of spirits. The figures of mummied servants, furnished with tools for agriculture or other work, formed a ritualistic substitute, like the paper garments burned by the Chinese to clothe their deceased ancestors, or the models of weapons and other useful objects buried with the dead by some American aborigines, and notably by the Chippewyans and the ancient Peruvians. They were consequently buried in great numbers with the dead, the number being probably an indication of the extent of the good wishes of friends. I have, among other specimens of these objects, one from the tomb of Deir el Bahari with the cartouche of Hatasu—I do not know whether the older queen of that name, or a later successor. It is made of pure white quartzose clay, imperfectly baked, so as to be soft internally, and it is covered with an intensely hard siliceous glaze of a brilliant greenish-blue colour, with black figures. The glaze is very infusible, perfectly free from cracks, and as fresh as if quite modern. I also have a small quantity of glaze of this kind in the mass. It was found

in a vase in a tomb near Thebes, and it is in fine sandy grains. It proves on examination to be a highly siliceous glass or enamel, very infusible, and coloured with copper. The specimen was given to me by the British Consul at Luxor, a noted collector of antiques, and probably represents the condition of the best quality of this glaze before it was melted on to the surface of the clay figures. Possibly the person in whose tomb it was found was a manufacturer, proud of the quality of his glaze. The Egyptians had at a very early period attained to great perfection in this kind of art, and some specimens used in interior decoration of temples and tombs are very neatly done. I have one specimen, from Tell-el-Yehudieh, which is a radiating pattern in white glaze on a grey or neutral ground, and another, from Thebes, in which hieroglyphics in grey are set on a white ground. In both cases the surface seems to have been incised, and the glaze or enamel neatly set into the cavities before burning.

The Canadian boatmen who went on Wolseley's expedition, were much struck with the extent to which mud is used in Egypt, for purposes to which timber would be applied in Canada. One of them naïvely remarks, that in Egypt mud is very plentiful, wood very scarce and dear. They were surprised to see mud fences and walls, floors, shelves, cupboards, cooking-ovens, and hearths. What struck them still more, was the practice of raising the gunwales of overloaded boats with a little wall of

clay, which, when sun-dried, actually seems capable of resisting water for a time. Dr. Schweinfurth thinks, and I believe correctly, that when the first colonists entered Egypt the country was well wooded, and that its primitive inhabitants used this material for their buildings; but this stage had passed away almost at the dawn of history, and now one of the greatest deficiencies of Egypt is the scarcity and dearness of wood.

A curious style of pottery found in some small Egyptian objects consists of baked clay saturated with green colouring matter, so as to give it the appearance of a green stone. The colouring matter would seem to have been a salt of copper, mixed with the clay before it was burned, so that the whole mass was tinted with it throughout. I have also some small figures of gods, which have been cut out of hard clay, and afterward burned or hardened in the fire. Whether this was intentional or accidental, I do not know.

When the earliest colonists entered Egypt, at a time when metal was scarce, and when men depended much on implements of stone, it must have been a pleasant discovery to find that the limestones of the Nile Valley are nearly as rich in flints as those of Syria and Arabia; and if they came from those regions they would naturally look for such treasures in their new country. It is, perhaps, not without historical significance that those regions of Western Asia and Northern Africa where the earliest civilized

communities are supposed to have been founded, are all well supplied with this important material of primitive art. However we may be disposed to despise the rude arts of the men of the Stone age, it is well to reflect on the fact that but for flint they must have been much more helpless. We cannot divide the history of Egypt into ages of stone, bronze, and iron. From the earliest times of its history all these materials were probably in use. It is true that General Pitt Rivers has found flints believed to be worked in the old pleistocene gravels near Thebes, but, on careful re-examination of the locality, I cannot concur in the belief that the flint flakes in question are other than the results of fracture by torrential action. The most abundant repositories of workable flints are, according to Dr. Schweinfurth, certain beds of the Middle Eocene. It is these that are worked at the village of Kerdasseh, near Gizeh, and similar beds were worked very extensively by Mehemet Ali, at Sunour, to the south-east of Cairo, to obtain gun-flints for his soldiers. At this place there are at present great heaps of chips resulting from this manufacture, besides which there are older cores and flakes belonging, as he thinks, to the work of the rude negroid tribes which, in ancient times, inhabited the region, and of whom the Ababdis of the Eastern side of the Nile are supposed to be descendants. Though these remains are in a certain sense prehistoric, there is no reason to believe them older than the older dynasties of

Egyptian kings; and it is certain that throughout their history the Egyptians used implements of flint for various purposes. A few instances of this may be stated here.

The numerous flint implements found in the vicinity of the baths of Helouan have been fully described by Mr. A. Jukes Brown.[1] From a visit to this place, and the study of his descriptions, I have no doubt that the objects of flint found here, and which lie on the desert surface, are of modern date. They include numbers of small and delicate flakes, or flint knives, some of them modified by edge-chipping, flint-saws worked with teeth on one edge, lance-heads, arrow-points, and scrapers, but the flake or knives and shapeless chips vastly predominate. The place was evidently a flint factory, and if we inquire as to the customers it worked for, the answer is, that the place was nearly opposite to Memphis and its great Necropolis, in the vicinity of the warm mineral springs of Helouan, and not far from the Turra quarries which supplied Memphis with stone. In such a place there would be a large demand for tools for working the soft limestone, for knives for ordinary purposes, as well as for opening mummies, for surgical operations, and for sacrificial rites. Cases of ancient surgical tools show us that in Egypt it was held proper to cut the human flesh in surgical operations only with knives of stone. Not only was this sanctioned by

[1] "Journ. of Anthrop. Soc."

long usage, but the surgeons of old time had always used this material, even in such difficult operations as trepanning the skull; for metal knives might poison the flesh, and might carry with them the germs of disease, whereas the fresh flint flake, sharp as the sharpest razor, and perfectly clean, was a safe scalpel. Among the Egyptians a favourite pastime was that of shooting water-fowl and small birds, and this was done with arrows tipped with hard wood, bone, or flint. A large proportion of the Helouan flints are of forms available for this purpose. Again, it seems certain that saws and bodkins of flint were used in sculpturing the limestone so extensively employed in tombs and buildings. If we examine with a lens the inscriptions on walls and stelæ, it becomes apparent that they were cut, not with chisels, but with pointed scrapers, probably chips of flint held in the hand, or handled in wood. In such inscriptions the bottom of the depressed parts is scratched as if with points, and little grains of flint and fragments of shell are worked round, as if with needle points. The flint-flakes which are found so abundantly near the tombs of the kings and those on the hill at Assiout, are in all likelihood the tools of the patient sculptors who worked on the inscriptions and figures in these tombs. If these chips are ruder than those found at Helouan, this does not imply any greater antiquity, for, as Mitchell has well shown in his work on the rude arts of Scotland, the decay of such arts often pro-

duces rude forms like those of its commencement. This is a principle worthy of more attention on the part of archæologists than it has received.

The large use of flint for hoes, harrow-teeth, threshing instruments, and other agricultural implements would lead us to expect much material of this kind in a country like Egypt. To this category may belong many of the larger and ruder objects of flint, which, because of their form, have been classed as "palæolithic," though found on the surface. The following remarks on this industry in America are pertinent here, as throwing light on certain classes of large flint tools found in ancient repositories.[1]

The American Indians, before the European discovery, carried on the culture of maize, beans, and pumpkins from the Gulf of Mexico northward to the St. Lawrence and the region of the great lakes. As they had no domesticated animals, their tillage of the ground was all done by manual labour; and their ordinary tool, according to the testimony of all the early voyagers and travellers, was that time-honoured implement, the hoe. In the absence of metal, this had to be constructed of wood, shell, bone, or stone, or some combination of these. Among many tribes a curved stick, or a stick with a branch or prong, served the purpose. Others attached to the wooden handle a flat bivalve shell, the blade-bone of a deer, or a flat stone, sometimes provided with notches at the side.

[1] See "Trans. Vict. Inst.," Feb., 1877.

The most artificially-constructed flint hoes known are those from the neighbourhood of St. Louis, described by Professor Rau in the Smithsonian Report for 1868, and by Mr. Jones, in his "Antiquities of the Southern States." I had an opportunity of inspecting one of these recently, in the collection of the latter gentleman. It was slightly rounded in the front of the blade, and evidently polished by long use in the soil. Near the upper part were two deep notches to facilitate its firm attachment with thongs to the end of the handle.

The more usual form of hoe found throughout the agricultural regions of America, is an oval or ovate flat chipped flint, not very dissimilar from many of those of the so-called Amiens type, but usually somewhat thinner, and often of very large size. Foster, in his "Prehistoric Races of America," describes several such implements from Illinois. Some of them are as much as thirteen inches in length, and may have been used as spades rather than as hoes. It is characteristic of these implements that they are found in large numbers together. Thus Abbot describes a cache of such tools, called by him hatchets, found in New Jersey, and containing one hundred and fifty. In the collection of the Brooklyn Historical Society is one of these implements, stated to be from a similar deposit. But, as might be expected, the greatest repositories of these tools are among the remains of the semi-civilized "Mound-builders" of the Ohio and Mis-

sissippi valleys, one of the oldest peoples of the American continent. Squier describes a deposit in Ohio, in which as many as six hundred of these tools were found, while a vast number besides must have existed in it. These were under a mound supposed to have been of sacrificial character, and their discoverer seems at a loss to conjecture their use.

The same writer informs us that the "Flint ridge," which is one of the quarries from which the mound-builders obtained the material of these and other implements, "extends for many miles, and countless pits are to be observed throughout its entire length, from which the stone was taken. These excavations are often ten or fourteen feet deep, and occupy acres in extent." Similar repositories of flints, where very extensive manufactures have been carried on, in the Uintah hills in Wyoming, are described in one of Hayden's reports on the Western territories. The occurrence of these roughly-shaped hoes in large deposits may be explained in several ways. Mr. Jones has pointed out to me a statement of Carver, that the makers of flint implements were in the habit of hiding away quantities of them until required for use, or for purposes of trade. Deposits of this kind would, however, consist of various kinds of weapons and implements, not usually of one kind alone. Again, in the case described by Squier, the accumulation may have been a great act of sacrifice. It was the

practice of the mound-builders to offer public sacrifices; and on certain occasions, agreeably to the rules of their worship, tobacco-pipes were offered, on others weapons, on others ornaments; and there seem to have been some of these rites in which agricultural tools were proper offerings, perhaps to secure an abundant harvest, or to avert injuries from the crops. Another, and probably more important reason was, that the tillage was often done by large bands of men and women working together on grounds common to the tribe. When the work was finished, the tools prepared for it would be covered up in some place where they could remain safely till again required. In the same way, and for the same reason, the stone gouges used by the Indians in their sugar-camps in spring were hidden away in numbers till the returning season again brought the tribe to the sugar-grove. It is also stated that partially worked flints were buried in the ground to keep them in their hydrated state, ready for working at a later time.

These facts, applied to the stone implements found in river gravels in Europe, give some probability at least to the theory that they were agricultural hoes and picks. An agricultural population would cultivate the alluvial lands near the rivers. They would seek in the neighbouring flint-gravels for the material of their hoes. After use they would leave these in their fields or garden-beds in large numbers. Subsequent river floods might mix the used and unused

hoes with the rejected pieces in the re-arranged gravel-beds, and all this might take place without mixture of the other implements used by the people. It would thus appear possible that the valley of the Somme, for example, may have been the seat of a primitive agricultural people, whose residence may have been in fortified "pahs" or villages on the high grounds, while their fields lay along the stream. Where they resided, domestic implements, pottery, and weapons of polished stone or bone may be found.[1] Where they laboured the fields, only palæolithic implements may occur. There may also have been contemporary hunting populations in the hills who would not use any hoes, but only spears, arrow-heads, etc. Further, in any case, such implements as hoes would be little likely to occur in caves or Swiss lake-like habitations, while they might be very abundant in valleys and the beds of streams. Lastly, the case of the American mound builders shows that a people may use palæolithic stone instruments in their agriculture, while they have in other respects attained sufficient civilization to possess polished and often elaborately-carved weapons, and ornaments of stone and metal, good pottery, and even textile fabrics. This, which was actually the case in America, may have also held good in prehistoric Europe.

In connection with this, it is interesting to reflect that the Scriptural history seems to imply the

[1] Genesis iv. 17; v. 29; vi. 1; vi. 21.

existence of a great agricultural population in antediluvian times in the valleys of certain rivers in Western Asia. If these people tilled the ground with rude stone implements before the extensive introduction of metals, and before the domestication of the ox, they must have left vast numbers of palæolithic implements to be swept away by the waves of the deluge, or buried in the river alluvia; and they must also have left behind extensive excavations and quantities of chipped stones in the localities where they quarried and manufactured their agricultural tools. All who attach an historical value to the Book of Genesis must be prepared for the discovery of such remains in beds far older than the oldest Assyrian monuments. We have perhaps a hint of the difficulties of the labour question in those days, in the saying attributed to Lamech on the birth of his son Noah, "This shall comfort us concerning our work and toil of our hands, because of the ground which the Lord hath cursed." Whatever the reason of the hope expressed, the saying is the groan of a man oppressed by the hard labour of manual husbandry, carried on perhaps with implements no better than the flint hoes of the ancient Americans.

We should not forget that the swarming population of ancient Egypt must have made a demand for implements which the moderate supply of the metals could scarcely meet, and that up to late times a great amount of work in stone and other

materials had necessarily to be done with flint. The cheapness of material was a great element in this. When in Egypt in 1844 I saw women in the market at Assiout, with baskets of flint flakes on sale. I asked the use of these, and was informed they were for strike-lights. I asked, "Why do they not use matches?" The answer was, "Matches are too dear for the fellaheen. It is much cheaper to have a flint and steel, and a little fibre from the spathe of the doum palm to light their cigarettes." I afterwards verified this by examining the tobacco pouches of some of the people, and exchanged with one of them a new flint for one that he had used so long that its front had been chipped into a semi-circular form, like that of one of those hollow scrapers one sees in collections of stone implements, and which are supposed to have been used for polishing shafts of spears, but some of which are possibly worn-out strike-lights of dubious antiquity. It may be observed here, that in the most primitive times, before steel could be obtained, the native iron pyrite was used for the same purpose, as evidenced by fragments of it found in very ancient burial-places and caverns of residence.

That the civilized Egyptians maintained the art of flint-chipping in great perfection for sacred purposes at least, is evidenced by the supposed sacrificial knives found in temples. One of these, found at Kom Ombos, has been figured by General Pitt Rivers, and is a beautiful example of flint-chipping.

The temple is of the date of Thothmes III., a little before the time of Moses, but was no doubt in use up to a much later time. On the other hand, the knife may have been a sacred relic handed down from a far earlier period than that of the great king to whom the founding of the temple is attributed. General Pitt Rivers has also directed attention to those curious ball and ring flat concretions of flint found in the limestone near Thebes, and of which I obtained many specimens.[1] They have been well described by Newbold, and their origin explained as a peculiar modification of flint concretion formed by the aggregation of a secondary rim of flint in the plane of the bedding around an original rounded nodule.[2] The Arabs call them "nuktah" or "drops," and they are often mistaken by imaginative travellers for artificial objects. General Rivers connects these curious concretions with the circular or ring knives sometimes found, and which may possibly have been worked out of these nodules, but, in whatever way worked, are a triumph of Egyptian flint-chipping, quite equal to that of the best ancient flint workers of Central America. They can scarcely have been used, as some have supposed, as bracelets, but may have been fastened on battle-clubs, or used as knives, or possibly were only curiosities worked by cunning artists in flint, as specimens of their skill.

[1] "Journ. of Anthrop. Inst.," 1887.
[2] "Journ. Geol. Soc. of London."

To bring to a close this long chapter, which might easily be extended to much greater length, I may merely add that nearly all the gems and ornamental stones were worked in very early times by the Egyptians. I have ring-stones, scarabs, utas or sacred eyes, figures of gods, religious emblems and beads, in carnelian, jasper, moss agate, onyx agate, rock crystal, chalcedony, Lydian stone, lapis lazuli, garnet, turquoise, emerald, hematite, alabaster, calcareous spar, fluor spar, serpentine, and a variety of other stones, as well as in coral and amber. The working of many of these stones also displays a great amount of skill and industry, and so far as known, most of them were used in very early times.

What, however, has all this to do with Egypt in its relation to the Bible? In the first place, it proves that the early colonists of Egypt were observant and cultivated men, yet they were such within a very few generations, or perhaps only a single generation, after the deluge. Consequently, their knowledge was that which had grown up in the antediluvian time. Had they been savages, they would probably not have been up to this time more advanced than the negroes of Central Africa are to-day. Further, if we compare their early progress and development of the resources of their country, even with that of the most prosperous modern colonies, we shall have good reason not to be ashamed of the primitive Egyptians. In short, we have no ground whatever to theorize as to long ages

of gradual ascent from a savage state, but, on the contrary, to believe in the inheritance by these people of an old civilization, and this the work of great inventors of the antediluvian age. It is useless to argue, as some have done, that the only alternatives are the suppositions of a spontaneous and slow growth of humanity, or, on the other hand, of a miraculous inspiration. The Bible story gives us the rational solution of the problem in the God-given gifts of great inventors, advancing humanity, and in the continuation of the advance gained by succeeding generations of civilized men.

Next, we have to take into consideration the fact that the Egyptian economic stones we have been considering speak of other arts and knowledge than that directly relating to themselves. The artificial wants to be supplied by architecture and sculpture pre-suppose a high civilization; and the existence of the agricultural arts of irrigation, drainage, and tillage, and domestication of animals, imply an orderly, settled, and industrious people, and security for life and property under a stable government. Let us observe that these are the facts affirmed by the Bible in relation to Noah and his family, and to the earlier populations of Chaldea, Palestine, and Egypt. The history of Abraham presupposes all these things in his time; and the monuments of Egypt and Chaldea agree with this, and carry them back still farther.

Finally, it thus follows that all we have learned

from the Bible as to antediluvian man, and early post-diluvian man, is vindicated not only by our studies of the cave men, and the physical geography of the post-glacial world, but by the testimony of those Egyptian stones which open their mouths to reply to the shallow historical criticism and materialistic evolution which have sought to place Bible history at variance with that of the older nations, and to evolve, by countless ages of slow advance, civilization out of brutal rudeness.

These facts being so, we may rest content to allow the antiquarians to settle in any way that they please the disputed lists of Egyptian kings, and may hold that the Hebrew Scriptures give us the best means of unravelling the questions connected with primitive man and the places of his earlier habitation.

I have taken Egyptian stones to teach these truths, because I have made them a special study; but other kinds of early art in Egypt tell the same story, and so does what we know of the early condition and history of Chaldea and Phenicia.



Kom Ombos.—An Egyptian temple built on the old alluvium of the Nile, above the level of the present inundation.

CHAPTER VI.

EGYPT AND ISRAEL.

Our chapter on Egyptian stones, while relating to the questions as to the connection of the antediluvian and post-diluvian ages, naturally leads us to Egypt itself, that cradle of early civilization and school of the Hebrew race; and we shall have occasion to see in its natural features and monumental history much that has left its impress on the Hebrew sacred books, and through them on the world.

The often-quoted saying of Herodotus, that Egypt is a gift of the Nile to the Egyptians, is perfectly true, if taken in a modern and superficial sense, and is fully warranted in that sense by the arguments used by the old historian himself. It is, indeed, as we shall see, to some extent true, even with reference to those older rocks which were formed before the Nile existed. Herodotus saw that the present Delta must once have been a shallow bay of the Mediterranean, and that the filling up of the bay has produced this expanse of cultivable land; and his estimate of twenty thousand years for the process, though excessive, in so far as the modern

period is concerned, is even smaller than that which some later observers have ventured to make. But Herodotus knew nothing of the nature of the rocks which formed the Nile sediment, or of the elevations and depressions which the country has experienced in Tertiary and recent times, or of the great geological agencies which were shaping the valley of the Nile long before man existed. For this reason, his ideas as to the sculpture of the Nile valley and the creation of that most wonderful country which lies along its course, were somewhat crude and inadequate, though not more so than those of the majority of modern travellers. To obtain more just and profound ideas, it will be well to transfer ourselves in imagination back to the time when the first ridging up of portions of the crust of the earth was laying the foundation of our continents. In this sketch, intended for non-geological readers, I shall adopt the historical method, and shall refer only incidentally or in notes, or in an Appendix, to the physical evidence of the facts stated.

In that early period of the earth's history, when the older crystalline rocks had been deposited, and were beginning to yield to the effects of the contraction of the mass of the earth, so as to fold and wrinkle, certain great plications were formed in the regions now constituting Palestine, Arabia, and Egypt, ridging up the crust in mountain ranges and masses of gneiss and other old crystalline rocks. The remains of these constitute at present the high

triangular mass of Sinai, bounded by the two depressions of the gulfs of Akaba and Suez, on the opposite sides of which are the two similar ranges running down the east and west sides of the Red Sea. (See Geological Map.)

In Egypt, the western of these old folds constitutes the Arabian range, extending between the Nile valley and the Red Sea, and widening out to the southward into the mountains of Abyssinia. The traveller, ascending the Nile, first meets with these old rocks at Assouan, the ancient Syene, where their hard ridges, crossing the river, produce the first cataract.

The margins of this original nucleus of Egypt continued for long ages to be the theatre of volcanic action ; and quantities of molten rock, granites, porphyries, and greenstones were introduced as dykes, and poured out as sheets along the sides of the gneisses and schists of the original ridge. The land was thus probably widened and extended, but we have no fossiliferous rocks to give us any succession of life in the region through a great space of the earth's earlier geological history.

At length, in the Carboniferous age, that in which the great coal formation of Europe was deposited, there came a quiet time. The old land was clothed with the quaint trees of that period, and the sea around tenanted with its marine animals, while the slow waste of the granitic mountains, and the action of streams and torrents, filled up the shallow

margins of the sea with beds of sand now constituting the lower part of the "Nubian sandstone" of Egypt, and the "desert sandstone" of the Sinaitic peninsula.[1] During this time a shallow sea covered nearly all of Syria and Egypt; but there may have been wide tracts of swamp and forest at the base of the insular belts of land. There is no evidence, however, of the accumulation of beds of coal within this region.

So far as known, the same geographical conditions continued until the Cretaceous age, that of the English wealden and chalk, when new sandstones were added, and parts of the old sandstones worked over, constituting the Nubian sandstones, properly so called, of Egypt and the east side of the Dead Sea, in Palestine.

In the Cretaceous period, that of the English chalk, and in the succeeding Eocene age, long-continued and widespread submergence of all the continental areas in the northern hemisphere occurred, and it is doubtful if anything except a few of the highest peaks of our ancient Egyptian land remained above water. At this time, in seas swarming with marine life, were deposited the great limestones and marls,

[1] I base this conclusion as to age on the *Dadoxylon* found in the Nubian sandstone in Egypt, and the fossils found by Schweinfurth in the sandstones near the Red Sea, and the discoveries of Banerman and Hull in the Sinai region. In the map I have ventured to refer to this age, portions of the sandstones skirting the Arabian range, and constituting the lower Nubian sandstone of Zittel.

probably three thousand feet in thickness, and full of fossils, which constitute the mass of the rocks of Egypt, Northern Arabia, and Syria, and which are seen in all the cliffs along the Nile and the Gulf of Suez. The deposition of these rocks must have required a long time, and within this time there were local elevations and depressions to such an extent that in some parts of Egypt and in the Lebanon we have evidence of low lands covered with vegetation, and shallow bays swarming with fishes.[1] These great limestones belong, in fact, to two of the great geological periods—the Cretaceous and the Eocene Tertiary; but in the countries now under consideration, the physical conditions in both were similar, and so far continuous, that it is sometimes very difficult to separate the deposits from one another. In all these long ages the Atlantic and the Indian and Pacific Oceans were one, and the same animals ranged from England to Australia. The traveller who ascends the Mokattam hill, near Cairo, or Jebel Attaka, on the Gulf of Suez, will find these fossils in the beds all the way to the summit, in evidence of the wide extent of the Cretaceous and Eocene seas. All the limestone rocks forming the cliffs on the Nile from Jebel Mokattam to the sandstone rocks at Silsileh, belong to these periods, and they lie nearly flat, so that the Nile

[1] The lignitiferous beds near Edfou and in the Lebanon, also the fish beds of Lebanon and Judea, to be noticed in the sequel.

valley and its transverse wadies have been cut out of them, first by the formation of two series of north-and-south, and east-and-west cracks or faults, and next by the action of the sea in times of submergence, and by the streams, when the climate was more moist than at present.

Great and important changes occurred in the Middle Tertiary, or Miocene, and in the succeeding geological ages. At this time all Northern Africa and Western Asia were raised out of the sea, leaving the Mediterranean and Red Sea only a little larger than at present, and subsequently rendering them even smaller than they are now. That this was really an elevation of the land, and not merely a recession of the sea, is evidenced by the bulging up of the originally flat limestones in great rounded arches, and by the formation of extensive faults, with the beds unequally raised at opposite sides, as we find in that long fracture of the Jordan valley to be described in the next chapter, and which extends all the way from the Gulf of Akaba into the Lebanon. Many such fractures of minor importance extend through the rocks of the whole region. In this way, and at this time were produced the beginnings of the north-and-south valleys of the Nile and the Jordan, and many transverse east-and-west valleys crossing them. The valley of the Nile, indeed, runs along a fault or fracture similar to that of the Jordan, but less pronounced in the extent of the vertical movement of its sides. At the same time,

the form of the eastern end of the Mediterranean basin, and the relation to it of the drainage of Western Asia and Northern Africa were fixed.

While these elevations were going on, perhaps slowly and by repeated efforts, new banks of sand and marly material were deposited. These are seen in the sandstones of Jebel Ahmar, near Cairo, which rest on the Eocene rocks, and in beds occurring in the Isthmus of Suez. From the fossil remains found in these beds we learn that the new land was clothed with forests, and that land animals similar to those found in beds of this age in Europe abounded.

A curious result of these movements was a renewal of volcanic activity, evidenced by the ejection of the trappean rocks, described by Schweinfurth, near Abou Zabel on the Sweetwater Canal, and by

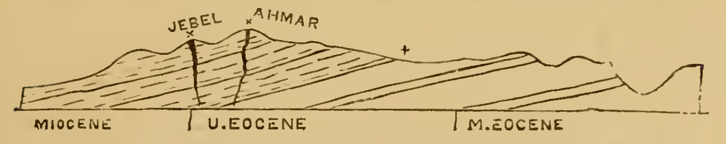


Fig. 20.—Section at Jebel Ahmar, near Cairo, showing Miocene sandstone and quartzite resting on Eocene limestone and marl. × × Openings of former siliceous springs. + Position of fossil trees.

the traces of hot mineral springs, or geysers, having existed near Cairo. It is to this period that the so-called petrified forests, near Cairo, which attract the attention of travellers, belong. The explanation of them is shortly this:—In the Middle Tertiary the valley of the Nile was forest-clad, bearing exogenous

trees allied to those of Central Africa,[1] and also palms and pines. Trunks of these trees drifted to the shore, became embedded in the sand, and were afterwards penetrated by siliceous waters, and their wood completely replaced by silica, so that they became permanently preserved. A little later, the soft sandstone containing these trees was swept away by water, leaving the trees exposed on the desert surface. In some places, as at Jebel Ahmar, where the sand itself was cemented into a hard rock, it remained, and the fossil wood may be seen in place; a convincing proof that it really belongs to this formation.

We may pause here to note that in all this long making of Egypt, preparation was being made for civilized man, and that not only the river and its alluvia, but all the rocks, from the old granite and gneiss of Assouan to the sandstone of Jebel Ahmar, were the inheritance of the Egyptians—those Egyptian stones already referred to, of which their great works are constructed.

And now comes a period of Egyptian history in which strange vicissitudes occurred to the country. First, at the close of the Miocene and beginning of the Pliocene, it must have been raised somewhat high above the waters. This is the first "Continental period" of Lyell, and affected Western Europe as well as Africa. Much remark has been made about the precipitous limestone cliffs along the Nile and the

[1] Species of *Nicolia*, etc.

deep wadies which lie at its sides. The formation of these in a rainless country has seemed inexplicable. But we must remember that the excavation of the valley and its branches has been going on ever since the first elevation of the country, and especially throughout the long Pliocene period, during which the land was from time to time higher and lower than at present, and there must have been many changes of climate. In the succeeding Pleistocene age it is likely that what was a period of cold,—the Glacial period,—in Northern Europe, was here a time of great rain and moisture. If we could have visited Egypt at this period, I have no doubt we should have found much of the cutting of the Nile valley and of the sculpturing of the country actively going on, or already accomplished.

The material thus washed out of Egypt was probably largely deposited in the bay which occupied the place of the present Delta, and constitutes the lower part of its deposits, the original foundation of sediment by which the bay was shallowed and fitted to receive the Delta deposits. It is, however, not unlikely that in one part of the Pliocene Continental period, the bay may have become dry land, and the Nile may have flowed eastward into a series of lakes or lagoons, occupying the present isthmus, and extending toward Palestine. The deposits of the isthmus contain fresh-water shells of species living in the Nile, proving a connection with that river either in Pliocene or Pleistocene

times, or perhaps at two distinct periods, one Pliocene the other Pleistocene. Little is known of the land life of Egypt in this period; but we have reason, from some bones in the isthmian beds, to suppose that, as in Europe, its fauna and flora were rich and varied, but perhaps in the later portion of the period assuming a more temperate character.

In the latter part of the Pliocene or in the Pleistocene age occurred a great subsidence of the land, contemporaneous probably with that of which we have evidence at this time all over Europe and America. In Egypt and Palestine the proofs of this are very decided. In the base of the Mokattam hill, behind Cairo, and in the corresponding rocks of the Pyramid plateau at Gizeh, on the other side of the river, we have, at an elevation of two hundred feet above the sea, old cliffs penetrated by boring or lithodomous shell-fishes (*Lithodomus*), and beds of oysters, scallops, etc., of modern species, which show that at this time all the Nile valley, as far up as Silsileh, was under water.[1] (Fig. 21.) At the same time the isthmus was submerged, so that Africa was an island, and the low plains of the Palestine coast were all under water. Nay, more, there is a terrace with sea caves on the Mokattam hill, about five hundred feet above the sea, and which may indicate a still more profound depression. There can be no question that much rock cutting was

[1] Dr. Schweinfurth has since my visit traced these marine deposits farther up the Nile than Gizeh.

done at this time, both by the sea and streams, and that much superficial sand, mud, and gravel were deposited, and now lie in part under the modern

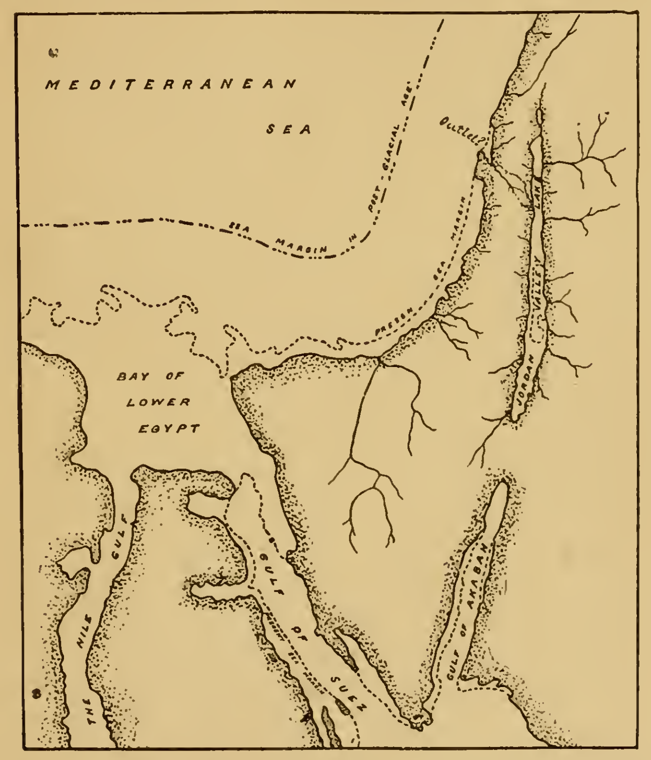


Fig. 21.—Map of Egypt and Syria during the Pleistocene submergence; showing also the present coast line, and approximately that of the post-glacial age. (Adapted from Hull.)

river mud. Such deposits have, as we shall see, been found in the deeper borings in the Delta and Nile valley, and also exposed on the margins of

the valley. These beds are well seen between Cairo and Helonan, and were found by Girard near Assiout; and the gravel and hard marl of Jebel Assart, near Thebes, also belong to this period (see Appendix). Old sea beaches of Pleistocene age also occur on the coast of the Red Sea. The greater extent of sea at this time also, and the cooler climate, would tend to a large rainfall.

Of the shells found on the sea beaches of this age, while all are modern, some appear to be Red Sea species,[1] while others are Mediterranean. This agrees with the fact that at this time there was a free communication between the two seas. The present separation by means of the isthmus occurred later. Let it be observed, however, that in the Eocene age the Mediterranean and Indian Oceans were confluent, that they were entirely separate in the Continental period of the Pliocene, that they again became confluent in the Pleistocene depression, and were finally separated in the modern time. At present they are not only separate, but scarcely any species are common to the two. This does not, however, indicate that the species have changed by any evolutionary process, but merely that when communication ceased, the climatal conditions allowed only Atlantic species to continue on one side of the isthmus and those of the warmer Indian Ocean on the other. The theories which have been promulgated respecting transmutation of

[1] *Ostrea Forskali*, *Pecten erithraensis*.

the species are purely gratuitous and unnecessary, and are disproved by the fact that the shells found fossil in the old sea margins or raised beaches, both on the Red Sea and the Mediterranean side, are identical with recent forms. The case is an interesting one, however, of the contemporaneous existence of two distinct marine faunas, close to each other, on the two sides of a narrow neck of land, and this difference established within a very recent time.

But to return to our history. The great Pleistocene subsidence was followed by a re-elevation, restoring the land to its former height and contracting the Mediterranean within its present limits, as explained in another connection in the second chapter. (See Fig. 1). This brings us to the post-glacial, second continental, or antediluvian age. At this time the great bay of Lower Egypt had been so filled up with deposits swept from the land, and was so raised up, that it probably became a desert, and was covered with wind-blown desert sand. The Nile, unable as yet to cut its way to the Mediterranean, may have again turned eastward, and spread over what is now the isthmus, perhaps finally running into the Red Sea—thus reproducing conditions which had existed before in the Pliocene period, and traces of which continued in the important branch of the Nile flowing eastward to the Red Sea in early modern times.

It was at this same continental period that Britain was united to the continent of Europe and

to Ireland, and that Africa and Europe were connected by a second isthmus by way of Sicily and Malta, as stated in a previous chapter. This was also the period of the earliest or palæocosmic men, who were contemporary in Europe and Asia with the mammoth and hairy rhinoceros, and of whom we had something to say in previous chapters. It was the antediluvian age, an age of great continents, of varied climate, of gigantic animals, of vigorous and long-lived men. It was great in everything except the elements of piety and humanity. That world was swept away by the Noachian deluge, the great post-glacial flood; and if there were men in Egypt at this time, they probably lived along the maritime plain skirting the Mediterranean, and have left no remains accessible to us.

We now come to that modern deposit which is really and practically the land of Khemi,[1] the Egypt of the agriculturist, that Egypt which is the gift of the dark-brown mud deposited by the river, and still in process of distribution. It is necessary that we should understand the origin and nature of this deposit, in order that we may appreciate either the antiquity of Egypt in relation to Bible history, or the reason of the place which Egypt has held among the nations of the world.

The first point that strikes us here is, that the Nile flows through a region practically rainless, and that

[1] Khemi, corresponding to the Biblical Ham, is one of the native names of Egypt.

no tributary streams enter it from its mouth up to the Atbara, which flows into it from the mountains of Abyssinia, nearly a thousand miles from the sea. Consequently, neither the water nor the mud of the Nile can be derived from the rainless district through which the river flows, but from the well-watered regions of interior Africa. The White Nile, which carries scarcely any sediment, is a somewhat constant stream, draining a country of lakes, swamps, and forests. The Blue, or Dark, Nile and the Atbara drain the mountainous country of Abyssinia, deluged with rain in the wet season; and it is these streams, swollen by violent inundations, that supply the Nile with its sediment, the quantity of fresh material carried into the river below the confluence of the Atbara being very small, as the results of the microscopic study of the sediment sufficiently prove. I have found by my own examinations of the Nile mud, that its composition is essentially the same along the course of the Nile all the way to the Delta,[1] though with some local differences in the fineness of the sand and the proportion of argillaceous matter. Thus both the water of the inundations and the material of the alluvial deposit come from a region of copious rains, and where decay of rocks may be supposed to proceed under the ordinary conditions.

Further, the rocks whose *débris* is borne down by the Blue Nile and Atbara are old crystalline forma-

[1] See also Prof. Judd, "Report to Royal Society," 1885.

tions, yielding to the water no soluble ingredients. Consequently, the waters of the Nile are, like those of a mountain stream, pure almost as rain water. Hence their celebrated "sweetness," in comparison with the more or less brackish waters which issue from springs and wells in the neighbouring desert. Thus we find a sufficient cause of the freedom of the Nile water from saline matter, in its derivation from a country of siliceous and crystalline rocks. If we compare it with the water of the Thames and other streams draining sedimentary districts, we shall find that they are all much more highly charged with saline matter in solution. It is rather to be compared with the water of the lakes and streams of the Scottish Highlands and similar districts of the older crystalline rocks. Dr. Sterry Hunt has described and referred to its true cause, a fact of the same kind, in the case of the Ottawa and St. Lawrence. The former, rising in a region of crystalline rocks, has little more than one-third of the saline matter in solution that is found in the latter, which drains principally a sedimentary country. The proportions in 10,000 parts are, for the Ottawa, only 0·6116, and for the St. Lawrence, 1·6055.[1]

Another effect of this source of the sediment is, that the Nile mud contains very little true clay or kaolin, but rather excessively fine sand. The explanation is, that the current of the river is sufficiently strong to wash out all the more finely com-

[1] Logan's "Geology of Canada," 1863, p. 565.

minuted argillaceous matter, and to carry it in its turbid waters to the sea. In connection with this, every voyager on the Nile when it is falling, must have observed how the mud-banks are constantly being undermined by the river, and their material carried down to be redeposited. This work goes on even more energetically in the time of the inundations. Thus any given quantity of sediment on its way from Abyssinia to the Delta is lixiviated thousands of times, and necessarily deprived of its lighter and finer constituents.

But the quantity of kaolin need not originally have been large. The older gneisses and schists do not kaolinize after the manner of Cornish granites, but, when decomposed so as readily to crumble into sand, they still contain much of their more refractory felspar in a perfect state.

These facts are further illustrated by the agricultural qualities of the Nile alluvium, as they have been explained by Schweinfurth and others. If the alluvial soil were a stiff clay, it would be practically incapable of cultivation in the circumstances of Egypt. If it were mere quartzose sand, it would be hopelessly barren. It is, in fact, an impalpable sand, highly absorbent of water, crumbling readily when moistened, and containing not merely quartz but particles of various silicates and of apatite and dolomite, which, though unaltered when under water, are gradually dissolved by the carbonic acid present in the cultivated soil, yielding alkalies,

phosphates, etc., to the crops.[1] In connection with this, recent microscopic examinations by Dr. Bonney of the old crystalline rocks of Assouan, which are probably similar to those farther south, show that, like those of Canada and Norway, they contain numerous crystals of apatite or calcium phosphate, a most important ingredient in fertile soils. Under the microscope, a soil of this kind appears not as a mere mud, but as a congeries of little crystals and crystalline fragments of various siliceous minerals shining like gems, and capable of being distinguished under polarized light. So fine is this material, that while the coarser grains fall quickly when the muddy water is allowed to stand for a short time undisturbed, some of the finer material will remain in suspension, giving a slight turbidity, even after thirty-six hours. The mud of the old lake basin, which is now the alluvial plain of Manitoba, shows similar characters, having been derived, like that of the Nile, in great part from the waste of crystalline rocks. Thus it happens that the Nile mud is not mere clay or flinty sand, but a rich mixture of various minerals, capable of yielding to the roots of plants, alkalies and phosphates and soluble silicates suited to nourish the richest crops. I was much struck with this when riding across the alluvial plain, here about eight miles wide, between the Nile and the ruins of the ancient Thinis or Abydos, the site of the tomb of Osiris, and the traditional

[1] See Analyses in Appendix.

earliest settlement of the Egyptians in the Nile valley. This plain must have been in tillage for at least 4,000 years, and its principal manure has been the Nile water, laboriously spread over it in millions of little rills by the industrious fellaheen. At the time of my visit, in January, it was covered with vast fields of beans (*Faba vulgaris*), said to be a native of Egypt,[1] and still largely cultivated there. These beans were, in many places, five feet in height, and showed by their strong growth, the great fertility of the soil, even after this long-continued cropping—a fertility literally inexhaustible so long as the fertilizing waters are supplied.

Thus we see, what at first sight seems to be the strange anomaly, that the river of Egypt comes charged with the elements of fertility to the fields of the husbandman, yet offers to him water like that of a mountain stream, pure and refreshing. No wonder that the fellah loves his river, and that his forefathers made it an object of worship, and that the Israelites loathed the brackish waters of the Arabian desert.

To the geologist and the historian, one of the first questions that arises out of these facts relates to the antiquity of Egypt and the comparison of the dates assigned to it with the chronology of the rocks and of the Bible. The subject is one on which historical and chronological reasoning have been

[1] According to De Candolle, the country south of the Caspian may also claim it.

lavishly expended, but, so far, with results less satisfactory than could be desired. Some would, on these grounds, extend the history ot Egypt to tens of thousands of years, while others are content with the more modest estimate of about 3,000 years B.C., a date which forms the starting-point of the more orthodox schools of history. If, according to a very moderate estimate, we reckon the three hundred and thirty kings who are said to have reigned in Egypt, at twenty-five years each, we shall obtain 8,250 years as the duration of the Egyptian monarchy before the Christian era. Such a date would, however, give to Egypt an antiquity more than double that of any other ancient nation, and it is liable to the great abatement that of the twenty-six dynasties of the Egyptian chronologer Manetho, according to some estimates five, and according to others, as many as twelve were contemporaneous with others. And it would seem that before the twelfth dynasty very little certainty can be obtained. This being the state of Egyptian chronology, it may be pardonable to inquire what light geology throws on the question, with the aid of the facts already stated in reference to the character of the Nile sediment and the result of its accumulation. It would seem, then, that when Menes, the first king, ascended the throne, the Nile valley was approximately in its present state. I say approximately, for though the alluvial plain, as far north as Memphis, permitted the existence of a city there,

we have reason to believe that the Delta was for a long time in the condition of a mere swamp, and it is at a much later time that we find cities and large centres of population in the northern parts of the Delta.[1] An Italian engineer, Figari Bey, estimated, as the result of borings, that the alluvial deposits of the Nile are sixty feet in depth; but so many patches of sand project above the surface of the Delta that a geologist would from examination of the surface, estimate the average at a much less amount. Besides this, the lower part of the deposit consists of sand and gravel, which may have been deposited before the present levels were inaugurated, and which probably belongs to the time of pleistocene subsidence. The shafts and borings sunk in 1832 to 1835, under the direction of the late Mr. Leonard Horner, showed various depths of Nile mud, reaching from zero to a maximum of fifty feet, and, as a rule, resting on quartzose sand, having the characters of the blown sand of the desert. Still more recent borings, probably more accurate than those of Figari, have been made by the British engineers, under Colonel Ardagh, and with the aid of a grant from the Royal Society. Before considering the results of these, we may recapitulate the beds which

[1] "The Egyptians told me," says Herodotus, "that the first man who ruled over Egypt was Men, and that in his time all Egypt, except the Thebaic canton, was a marsh, none of the land below Lake Moeris then showing itself above the water. This is a distance of seven days' sail from the sea up the river" (Rawlinson's "Herodotus," Book II., Chap. 4).

ought to exist in that great Egyptian bay which afterwards became the Delta. Assuming that the original bottom consists of the Eocene limestone, or of the Miocene beds overlying these, the first deposit should represent the equivalent of the isthmian beds deposited in the period of elevation in the Pliocene; these may either have been mere desert sand, or in part marls and clays, with calcareous bands and concretions, like those of the isthmus. On these should rest the marine or estuarine deposits belonging to the time of Pleistocene submergence; and since this was probably a period characterized by great rainfall, and in which much erosion took place, it should be a somewhat thick deposit, containing more calcareous matter than the present Nile mud, and locally containing gravel beds. Next, we might expect deposits of more sandy character, corresponding to the Second Continental period; and if man had reached Egypt in this period, his remains or implements might possibly occur. Next, we should have the diluvial deposits, corresponding to the loess of Europe; and lastly, the mud deposited within the historical period. All this we should have a good right to expect in the material filling this great and ancient depression. It is to be observed, however, that we may expect these deposits to vary very much in thickness and quality in different places, and some of them to be locally absent, while old channels, subsequently filled, might give a great depth of

uniform mud; and localities near the margin of the plain would show desert sand mixed with the true Nile deposit.

Let us now take one of the principal Delta borings, as reported on by Professor Judd in the Proceedings of the Royal Society.[1] In this we shall, I think, find evidence of three, at least, of the beds above postulated.

Summary of Boring at Tantah, in the Delta.

I. Samples 1 to 5.—Brown clay and loam, being ordinary Nile deposit, top to 31 to 40 feet. Mud with from 1·71 to 39·43 per cent. sand—the latter in the bottom.

II. Samples 6 to 10.—Sand ranging from 99·53 sand to 59·09, with some mud; average 87 per cent. sand, or omitting No. 10, 93 per cent. sand. Desert period and Pleistocene submergence, 31 to 40 feet to 58 to 68 feet.

III. Samples 11 and 12.—Reddish brown and ash-grey clay and loam. Rounded grains of quartz and various minerals, with calcareous concretions and coarse sandy mud. Pleistocene and Pliocene?[2]

The first of these groups of samples I regard as

[1] Vol. xxxix. Nov. 19, 1885.

[2] The borings have since been continued to a much greater depth, I believe, in material on the whole similar to No. III. This should locally be of great thickness, representing as it does that Pleistocene and Pliocene scouring out of the valley and its tributary wadies, referred to above.

representing the modern deposit, properly so called. The second represents the deposits of the deluge and the sand of the arid conditions of the post-glacial; and the third has the characters of the deposits of the Pleistocene subsidence. The boring may still have to penetrate two other series of loose deposits before reaching anything of the nature of solid rock. Now, if we assume forty feet for the thickness of the strictly modern deposit at this place, and bearing in mind that in certain parts of the Delta it diminishes to nothing, assume thirty feet as its average thickness, we may make the following calculation of its age. We may assume the average rate of deposition at one fifteenth of an inch per annum, which is not an extreme allowance,[1] and this would give say 5,300 years. But from this we must deduct something for the probably greater deposit in the earlier part of the modern period, and for the less amount of mud swept out to sea than at present. Making these deductions, we may fairly assume for the time occupied in the modern deposit, in round numbers, say 5,000 years. It is certain that some portion of the mud had been

[1] M. Girard, in the "Description de l'Egypte," estimates from the deposit since certain dates on the old Nilometers, five inches per century, or say $\frac{1}{20}$ of an inch per annum. Horner, from localities at Heliopolis and Memphis, in both of which the deposit was probably exceptionally small, allows only 3½ feet per century. The deposit, however, must have been greater in early times, and must have continually diminished, especially on the higher and marginal localities.

laid down before the arrival of the first colonists, so that we cannot assign to their appearance in the country a greater antiquity than 3,000 B.C.

This measure of time is the more reliable, since we know from the geological history already given, that there was no Delta, but only a desert where it now is, in the antediluvian period. If there was any Delta deposit at that time, it is now under the Mediterranean. Thus the Delta mud, properly so called, is strictly a post-diluvian deposit, and it gives a fair measure for the history of Egypt, assuming that this began shortly after the deluge. We may further note that this agrees with the dates assigned to the beginnings of most ancient nations, and to the close of the post-glacial period, as now deduced from such physical changes as the recession of the Falls of Niagara and the rate of denudation of the continents generally.

Thus, whatever may be the conclusions of historians respecting the chronology of Manetho, geological evidence will scarcely allow us to claim for any possible post-diluvian settlement of the Delta, a greater antiquity than that above stated. A corroboration of these views as to the date of the Nile alluvium may be found in the proofs of the cutting back of the river channel, as I have explained it in the little work already referred to.[1] Though the Nile valley depends primarily on causes anterior to the erosion of the modern river, that erosion has been

[1] "Egypt and Syria."

potent in removing obstructions in its course. The sandstone ridge at Silselis must have dammed up the Nile waters to the south, and the height of this obstruction is shown by the high banks of old Nile mud above that place. On one of these the temple of Kom Ombos is built (see Fig. facing this chapter); and as it is at least as old as the time of Thothmes III., this barrier must have been cut through in very early times. The cutting of the gorge at the first cataract must have been later, and above it there are similar high banks of the old Nile mud. But Lepsius has shown that there is evidence that as late as the time of Usertesen III. of the twelfth dynasty, the river at Wady Halfa rose twenty-four feet higher than now, so that, at that time the first and second cataracts were not cut down to their present levels. This brings before us the fact that within historic times, and subsequent to the foundation of the older Egyptian cities, there may have been great and rapid removal and redistribution of sediment, and perhaps, violent debacles tending greatly to increase the deposition in the lower parts of the river, and to make the Delta and its vicinity more important relatively to the portion of the river above the first cataract. Such changes might have caused, in early times, movements of population of which we have no historic records. In any case, this fact indicates the liability to exaggerate the time required for the deposit of the modern alluvium.

The uncertainties attending such calculations are also shown by the controversies which arose respecting Horner's estimate of time taken from his shafts and borings near Memphis. It was objected by Sharpe that the area of the old temple of Memphis had been guarded for ages by embankments, and that consequently the mud accumulated there had all come in since they had been ruptured or overflowed. Lubbock replied to this, that it made no difference, since this sudden filling merely brought the area up to the general level outside. This reply was accepted by Lyell as sufficient,[1] but it evidently is not, since the site of Memphis must originally have been a place of unusually thick deposit, raising it as early as the time of Menes above the inundation, while subsequently it must have been an area of minimum deposition, during all the time of Egyptian history subsequent to the erection of the dam built by that old king, some distance to the northward. It is curious that the site of Heliopolis, also tested by Horner, is liable to a similar objection, being in a position where, on the edge of the desert, the deposit of mud must have been small, and perhaps for a long time absent altogether. Neither of these sites, therefore, furnishes an accurate criterion. The borings more recently undertaken will give better data, but they require to be extended more widely. It would be a very interesting field of investigation for geologists and archæologists

[1] "Principles of Geology," chap. 18.

resident in Egypt to explore the raised banks of sediment above Silsilis, and to ascertain if they contain any works of man, and of what date.

The most patent objection to thus shortening the dates claimed by some Egyptologists, is that founded on the very early development of the arts, and of great public works in Egypt. Of course, if we are to suppose all this to be the result of a slow advance from barbarism by a gradual and imperceptible evolution, we should have to push back the first settlement of Egypt to a time long before we have any evidence of the existence of man. We have already seen, however, that civilization must have been advanced by sudden bounds under the influence of great inventors, that, according to the Bible narrative and geological probability, it had made great advances before the deluge, and that the first post-diluvian settlers in Egypt were probably civilized men, well acquainted with the working of wood, stone, and metal, and proficients in that art of husbandry by irrigation, of which we have a hint even in the primitive description of Eden. Let us take, however a crucial case.

The pyramids of Gizeh have been objects of wonder and speculation, from the time of Herodotus until now. That they were royal tombs, no reasonable person can now doubt. That they exhibit wonderful perfection in the art of building, and the command of an enormous amount of skilled and unskilled labour, is most evident. That they were

erected by the early kings of Manetho's fourth dynasty is undisputed; and if we are to accept the Bible chronology, we cannot place the time of these kings more than a few centuries after the deluge. The names of these pyramid kings, thanks to the imperishable nature of their monuments, are well known, and a life-like portrait statue of one of them, Kephren, now sits enthroned in the Boulak Museum, nearly as perfect as when it left the sculptor's hands, and presents to us the countenance of a grave and thoughtful man, of genuine Egyptian type.[1] The funeral eulogium of another, "Menkera, living for ever," may be read on the cover of his coffin in the British Museum. There are older pyramids than even those of Gizeh, though some of them are much ruder, and all are much smaller. They are all legitimate successors to the funeral mound, which is the oldest mode of sepulture of great men in nearly all parts of the world; and Osiris, the great patriarch of the Egyptian race, who came thither with his children, or whose remains were brought with them, is reported to have been buried under a mound at Abydos, the earliest settlement of that band of immigrants who came into Upper Egypt from the Red Sea.

The pyramid attained to its maximum for all time in that of Kufu or Cheops, the "Great Pyramid," *par excellence*, 482 feet in height, and a miracle of skilful masonry in the construction of its internal

[1] See figure in last chapter.

passages and chambers, the accurate levelling and measurement of its sides, the perfection of its form, and the beautiful fitting of its external casing.[1] It has endured in all its magnitude to our time; and, but for wanton destruction, its outer surface would have presented to this day all its pristine beauty. Yet Kufu, or Cheops, the builder of this magnificent tomb, was probably buried in it not more than 300 or 400 years after the first settlement of Egypt. At first sight this seems incredible; but there are other parallel facts. The growth of the Israelites from a single family to 600,000 footmen took place in this same country in less time. The increase of the population of the United States of America to fifty millions, and the works they have produced, are vastly greater. It is true, the circumstances were different, but in the case of Egypt, we have all that could be desired in abundance of food and other resources, so that everything was favourable to the rapid increase of population, and there were probably no foreign enemies to contend with. In such circumstances the numbers and wealth of the people must have grown with marvellous rapidity, and the government, after providing for the maintenance of canals and embankments, must have had a large surplus. It is likely, also, that advantage was taken of the peculiar circumstances of Egypt in relation to

[1] Petrie, "Pyramids of Gizeh." Maspero has discovered the ruins of another pyramid, which may have been as large as that of Kufu.

obtaining workmen at certain seasons. Herodotus was informed that 100,000 men were employed, for three months at a time, for twenty years, in building this pyramid. This, as Mr. Petrie has well pointed out, agrees with the physical conditions of Egypt. During the inundation, that is, from the middle of August to the middle of November, little agricultural labour can be done. At this season any number of workmen can be secured. It is also the best season for the transport of heavy stones. If, therefore, the king employed this season of the year, and took care to provide abundant food for his levies, he might give employment to his subjects at a season otherwise unprofitable, while he erected his own monument. In this early period also, work was not done by foreign slaves. These were introduced under the great conquering dynasties of a later time. We may thus understand how great public works might be constructed in the time of the early monarchy, with benefit to the people. It is pleasant thus to be able to regard the pyramids as public enterprises, undertaken, not to oppress the people, but rather for their profitable employment, and to disperse among them the contents ot an overflowing treasury.

But the early Egyptians were not solely occupied with the erection of tombs and temples. There can be no doubt that the canals and embankments for irrigation were commenced at an early time, and were pushed forward by degrees, as population increased; so that it is probable that by the time of

the twelfth dynasty, when all Egypt became consolidated under one government, and the Egyptian kings took possession of the extreme east and north of the Delta, the arrangements for the distribution of the water of the Nile were as perfect as at any subsequent time; certainly better than at present, when the British government has undertaken, under the skilful management of Sir Colin Scott Moncrieff, a worthy successor of King Menes, to restore and perfect those great works, an enterprise which, if completed, will be one of the greatest benefits conferred by the British upon Egypt, and will much increase the productiveness and wealth of the country.

One of the most remarkable of the great engineering works of the ancient Egyptians was that whereby the depressed area, now known as the Fayoum, the ancient Arsinoïte Nome, became one of the garden lands of Egypt. According to recent maps[1] this area consists of two depressed basins, lying west of the Nile, between Memphis and Beni-Suef. The lowest parts of these are as much as one hundred and eighty feet below the level of the Mediterranean, sloping up toward the hills west of the Nile. They are no doubt natural depressions produced by subsidence, like that of the Dead Sea in Palestine; and the northern hollow has at the present time a lake without outlet, the Birket el Queroum. The entire length of the two depressions from north to south is more than one hundred miles, and a portion of the

[1] Of Dr. Schweinfurth and Mr. Cope Whitehouse.

higher part of it, about forty miles in diameter, now constitutes the cultivated district of Fayoum. This depressed area communicates indirectly with the Nile by the long canal parallel to the river, called the Canal of Joseph. The waters of this are carried through a gorge in the bounding hills of the Nile valley, and after irrigating the Fayoum, the surplus evaporates from the lake in the lower part of the depression. It would seem, however, that in early Egyptian times an immense lake existed here, which was used as a storage basin for the surplus water of the inundation, and around which was a fine and cultivated country, rich and populous. The reclaiming and use of this district were attributed to a fabulous king, Moeris, but are now believed to have been the work of the great king Amenemhat III., of the twelfth dynasty. The district has assumed many forms at different times, in accordance with the amount of water supplied to it, and the state of repair of its canals and embankments, but would seem to have attained to its maximum utility and value before the time of Herodotus. It excited the utmost wonder of the Greek historian, who however believed, contrary to the fact, that this depressed area was an artificial excavation. He describes it as a vast lake, 3,600 furlongs in circumference, with two colossal statues in the midst,[1] and cities and

[1] Petrie has recently shown that the so-called "pyramids" of Herodotus were pedestals of colossi of quartzite, each thirty-five feet high.

populous country around. This inland sea was formed by turning the surplus of the Nile inundation into a naturally depressed but desert area. This great work may have been effected, in part at least, as early as the time of Abraham, more than a thousand years before the time of the "father of history." It has recently been proposed again to use it in receiving the surplus waters of the inundation, and as a means of reclaiming the marshy parts of the Delta now lying waste. Of course the story that has been retailed, that this great basin is an artificial excavation, is ridiculous; but the utilizing of it as a storage basin for the Nile, and in connection with this, the conversion of a desert into a fertile land, so as to form a province of Egypt, was a very remarkable work of engineering skill.

The determining element in such great works as those above referred to, is not mere lapse of time, but the energy and skill of an enterprising and industrious people, under an enlightened government, and free from foreign invasion. This was the old Egypt of the times of the Hebrew patriarchs, and before that great invasion of the barbarians from the East, known as the Hyksos or shepherd kings.

To return to our geologico-historical sketch. It was probably not many centuries after the great flood had passed away, and when the Nile had assumed its present characteristics, and its valley was already nourished by its deposits, and clothed with rich vegetation, that some early colonists made

their way into Egypt, possibly by two lines of migration, one across the Red Sea into Upper Egypt, the other by way of the isthmus from Palestine.[1]

These first inhabitants must have found in the Nile valley a secluded dwelling-place, where they were to a great extent exempt from the vicissitudes of the outside world. They found a country rich in all that could minister to human wants, and in a space of time only paralleled by the growth of great nations in America in our own time, they became a rich and powerful people. At the same time the features of their country, in its strange aspect, in its mysterious inundations, its rainless climate, its gigantic and formidable beasts, and exuberant vegetation, gave them a tendency to that peculiar form of nature-worship and symbolism, which, founded on a primitive monotheism, grew up and flourished in Egypt in a manner unexampled elsewhere. In regard to their political organization, we can see in their history, as in that of some other ancient countries, first a limited nationality under a single king or patriarch, then a tendency to break up into separate small and rival kingdoms, and then a re-

[1] The Nile is sometimes called a sea in the Bible, owing to its great magnitude (Nahum iii. 8.) The same usage exists in Arabic, in employing the word Bahr for the river. Another name in Hebrew is Sheekor, the black river, derived perhaps, like Nilus, from the colour of its muddy banks. The word Khemi, the name of the people, is sometimes supposed to be of the same origin; but, according to the Bible, it comes from Ham or Khem, swarthy, the name of a son of Noah.

union of these, perhaps under the pressure of foreign invasions, into a great and powerful monarchy. In their religion we find an original worship of the Creator, localizing itself under different symbols in different places, until it grew into a plurality of gods, added to by worship of ancestors, heroes, and attributes of the divinity, and crystallized into a complex ritual and powerful priestly caste, till it became one of the grandest of the organized superstitions of the world. With all this, as we have seen in the last chapter, and as we shall see farther in this, there was a high civilization and a thorough mastery and use of all the resources of the country.

It seems to be rather an abrupt transition, to proceed from Nile mud to religion; but I think it is Herodotus who remarks that the Egyptians did not need to worship the weather-gods of the Greeks, because the Nile fertilized their land without the aid of rain. There can be no question that this climatal difference had much to do with the peculiarities of Egyptian religion; and Moses puts this truth in a different way when he reminds the Israelites that Egypt was not a land watered by the rains of heaven, but laboriously irrigated with the foot, like a garden of herbs,[1] which is exactly what one sees in Egypt to-day.

Menes, we are told, established Divine worship and built temples therefor, before the time of Abraham; but at quite as early a time, the Chaldean

[1] Deut. xi. 11, etc.

king, Uruk, had erected a temple, apparently for the worship of the heavenly bodies, at Ur of the Chaldees, the still extant temple mound of Mugheir. Nearly at the same time, Abraham himself, the great prototypal dissenter and puritan, was making his protest against a plurality of gods, and fraternizing with Melchisedek, king of Salem, in offering sacrifice to the one Most High God (*El Elyon*).[1] These are probably the oldest historical facts respecting any organized form of religion, unless we go back to the primal worship of Cain and Abel; but this was presumably identical with that subsequently revived by Abraham. The aboriginal worship introduced by Menes is said to have been that of Pthah, the Creator, who is more properly, perhaps, the Ruah of the Hebrews, the Pneuma of the Greeks, the Divine Spirit giving order to previous chaos, for it would seem that Ra was the supreme god of Egypt, as Il or El was of the Chaldeans and Hebrews. With this soon became associated the worship of Osiris, who was a deified ancestor, accepted by the Egyptians as the redeemer and judge of mankind. This was the aboriginal trinity of Egypt, and one cannot help seeing throughout the history of the people the supremacy of these gods ever cropping up. With this the Egyptians retained in its full integrity that which is the common property of all religions worthy of the name, the doctrine of a spiritual life, a future judgment, a final resurrection.

[1] Gen. xiv. 18.

The temple halls and the tombs everywhere bear silent and impressive witness to the reality of this belief, which, however it may have been corrupted for mercenary purposes by a debased priesthood, still carried with it the Divine sanction of a high moral code and a final retribution. That this primeval religion should accept an endless variety of natural objects as emblems of the gods, and as even themselves subordinate divinities, was almost a matter of course in a country where nature, both inanimate and animate, is so pronounced in its appeals to man as in Egypt; but this, no doubt, belonged largely to the exoteric worship intended to attract the common people, as did also the majestic temples, the gorgeous ritual, and the imposing processions and ceremonies. This was the religion into the presence of which the simple children of Israel were brought from their pastoral life in Palestine, and these the people with whom their blood was largely intermixed in Egypt; for we may be sure that the marriage of Joseph with Asenath was not a solitary case, though this gave to two of the greatest tribes of Israel a mixed Jewish and Egyptian parentage. Their history in Egypt, whether in the prosperous times of Joseph, or in the oppression which followed, is of the same type with what has been occurring in the East from time immemorial, and is still occurring. The court of Mehemet Ali, in his time of *quasi*-independence, was not unlike that of Pharaoh; and the forced labour of hundreds of men, boys, and girls which one

sees now on the Egyptian lands and dykes, is but a repetition of what the Hebrews suffered.[1]

To what extent the Israelites conformed to Egyptian religion we do not precisely know; but the excavation of the temple of Pithom shows that the worship of the Egyptian gods was established in their midst by Rameses II., the king of the oppression; and the readiness with which they accepted Aaron's imitation of the bull Mnevis in the golden calf, shows that this emblem of the great Ra of Heliopolis had some hold on their affections.

On the other hand, we shall find that there is good reason to believe that the strange revolution whereby, about the time of Joseph, certain kings of Egypt seem to have abandoned the ancient Egyptian polytheism for a species of monotheism, the worship of Aten or Adonai, symbolized by the disc of the sun, may have been an effect of Hebrew influence; and when the reaction against this, under the Theban priesthood, became triumphant, this may have tended to render them and their religious ideas distasteful to the government and the people.

The fact of the revival of the old Abrahamic monotheism in its strictest form by Moses, and of its acceptance by a people reared in the presence of the gorgeous ritual of Egypt, is to my mind one of the most unequivocal examples in history of a Divine interference in the affairs of men. The circumstance

[1] The worst features of this "*corrée*" are now being amended under British rule.

that there is much in the arrangement of the tabernacle, in the vestments, and in the sacrifices of the Aaronic ritual that coincides with Egyptian modes in no respect extenuates this ; it even renders it more remarkable. The contrast in the results of the two systems is equally marked; the one reaching forward into Christianity, and developing a literature which has penetrated and revolutionized the whole world, the other expending itself in mere form and show, and hardening into a system of ecclesiasticism which went down and crumbled into dust before primitive Christianity. The history is one full of teaching for the time that now is. Living religion and living a religion constitute something entirely different from contriving hard and brittle systems without life and without tenacity.

Since the time when the iconoclast Cambyses made war on the gods of Egypt, the religion of the country has been the sport of a great variety of influences—Persian, Greek, Roman, Judean, Christian. It now lies crushed under a system which, though nominally monotheistic and iconoclastic, yet in its hard ritualism, its senseless bigotry, its narrow fatalism, and its denial of the rights of woman, is probably the worst and most demoralizing the world has ever seen. No one who has studied the state of society in the East can have failed to observe the fatal blight which, whether in its fanatical outbursts or in its decay, Islam casts on the populations under its shadow. Yet, under this, there lie remnants of all

the faiths preceding it, from Coptish Christianity back to the old Pthah-worship of Menes, embers which may yet be fanned into a flame under the influence of Christian missions and modern education.

It is characteristic of the early times, that Menes, the first king, was occupied with the making of canals and otherwise improving the drainage and irrigation of the country, and that he is said to have been devoured by a crocodile. It is equally characteristic, that some of the greatest works in canals, temples, and tombs, and some of the noblest art, belong to those earlier dynasties under which the country was growing in power and was united; that a period of much confusion and doubt follows the disintegration into petty kingdoms; that great works reappear when the whole became reunited; and that the invasion of the Hyksos raised up powerful and despotic kings, who not only reigned over the whole country, but carried the arms of Egypt into foreign lands. We shall see, further, that the emigration of the Hebrews and the mixed multitude that followed them permanently weakened the nation, and paved the way for its final subjugation by foreigners.

The ethnological type of the ancient Egyptian is well seen by the early statues that have been preserved to our time. In the Boulak Museum, at Cairo, are many statues of the earlier dynasties, representing priests and public officers and dignitaries; and since, in art, this was an age of careful portraiture, and not of that idealized convention-

alism which came into fashion in the later periods, we can see in these statues the veritable features of men and women removed only a few centuries from the date of the great flood of Noah. (See Fig. 17, Chap. V.) Judging from these figures, the originals were people of moderate stature, of plump and rounded figure, with well-formed heads, somewhat full faces, of mild aspect, and with a very moderate development of the jaws, cheek bones, and nasal bones. Their style of countenance is indeed much that of the modern Copts, among whom one often sees faces strikingly like those of the most ancient statues. I think we have a right to infer that the genius and capacities of the people were also not unlike those of the Copt of to-day—industrious, peaceful, patient, light-hearted, uncomplaining, with much mental acuteness and mechanical skill, but not endowed with the more rugged and aggressive powers of the more northern nations. They were by no means negroid in aspect, though brown in colour, and with a certain fulness of lip and breadth of nose; but they show little of the salient features characteristic of the Semitic and the purer Aryan races, or of the flat and broad face of the Turanian. Among European populations their nearest allies were the Iberians of the West, and the old Etruscans, and they have certain points of resemblance to some of the older populations of India. They are intermediate between the Cushite and the Aryan, or between the finer type of Tura-

nian and the Aryan. In short, the oldest style of Egyptian is in colour and form a somewhat average type of humanity, and equally distinct from the negro populations of the South and the Syrian peoples of the North. This is the primitive and finest type of Egyptian; and though it is much obscured in the later history by mixtures of foreign races, it still persists in a marked manner among the Copts, who are at the present day the best and most useful and progressive of the native Egyptians, and those who retain most of the capacity of the old race for culture and advancement.

At an early period of their history, that of the dynasty called the fourteenth, the Egyptians came into unpleasant contact with a very different race—that of the Hyksos or shepherd kings. These people entered Egypt from the Asiatic side, and apparently took possession of the whole of the Delta without a struggle, and established their headquarters at Zoan, a city perhaps originally built by Asiatic immigrants, since in the Bible it is placed in connection with Hebron, as founded seven years later.[1] Perhaps they came little by little in successive hordes, and so gradually occupied the country; or, perhaps, on the contrary, they came in so great force and so well prepared for war, that resistance seemed hopeless, and the royal family and principal public officers fled into Upper Egypt.

Terrible stories were told of these people; and

[1] Numbers xiii. 22.

in the time of Joseph every shepherd was an abomination to the Egyptians; but it is difficult for us now to learn much respecting them. They were probably a people at first destitute of the Egyptian ideas of building and monumental commemoration; and when, later, in the period of 500 years[1] through which they are said to have ruled, they executed statues and other permanent monuments, these seem to have been industriously destroyed or buried out of sight when the time of revolution came. Thanks, however, to the laborious researches of Mariette Bey and Maspero, there are in the Boulak Museum a few representations of these people, more especially a sphinx with a human head, supposed to represent one of the kings, Apepi by name, whose cartouche is sculptured on it. A few representations of these people have also been found here and there in European museums.[2] As one looks on the grand old diorite face of Apepi, it is possible to read thereon the whole history of the Hyksos. Stern, broad, with high cheek bones and firm, strong mouth, prominent straight nose and furrowed brow, it has that hard, stolid expression which is bred in men by generations of struggle with man and nature. The form is not Semitic or Aryan, but Turanian, and is altogether different from that of the native Egyptian kings of previous and succeeding dynasties

[1] This period is probably exaggerated, and may not have exceeded 150 years.

[2] Tomkins, "Times of Abraham."

(Fig. 22). In the old world it resembles nothing so much as the face of some of the Northern tribes of Asia and Europe; and to one familiar with the countenance of the natives of America, it recalls



Fig. 22.—Head of a Hyksos sphinx at Boulak (after Tomkins).

some of these. The face of Big Bear, a Cree chief concerned in a recent outbreak in Western Canada, is very similar, though a trifle coarser, that of his ally, Poundmaker, approaches to the same style; and the face of Red Pheasant, a Cree chief who

took part in the Manitoba disturbances of 1885, is of the same type (Fig. 23). That these were just the sort of people fitted to trample on the quiet,



Fig. 23.—Red Pheasant, a Cree chief.

industrious Egyptians, no one can doubt. The wonder is, how they were expelled; and this, I fancy, is to be accounted for by the probability that in the course of time they had become weakened by

luxury, and perhaps intermixed with their subjects, and had lost the more vigorous qualities of their ancestors. These people were certainly not, as was at one time supposed, Hebrews. The time of their appearance in Egypt was at least as old as that of Abraham, and not unlikely they belonged to a series of waves of migration westward and southward, of which that of the family of Abraham was a part. Their movement into Egypt may indeed have opened the way for his entrance into Palestine. Nor were they Canaanites or Amorites. The features of these people, as represented on Egyptian monuments, and in the modern fellaheen of Syria, were of a different pattern, and more like those of the Jews and Phenicians. The only people referred to in the Bible, who can be supposed to represent them, are those prehistoric peoples, the Anakim, Emim, Zuzim, etc., whom Moses represents as associated with the Hittites, and preceding the Canaanites in Syria. It is curious also that these people are called Nephalim, the same term used for the gigantic antediluvians, whom in feature these people certainly resemble, and partly also in bodily vigour and disposition. It is also worthy of note that the Hyk or Huk for king may be identical with the *og* or *ag*, applied to the kings of these prehistoric people, and which is identical with *og* and *ogama*, terms used in the same way by certain American tribes. Another derivation is from *hak* or *hek*,[1] a

[1] *Hac* may be derived from the familiar root "hack," either

name for prince, which appears in the Book of Judges, in the song of Deborah. It is reported that a race still exists in the marshes of Lake Menzaleh, which has some of the physical peculiarities of these ancient people. If we inquire as to their origin, two theories are possible. Either they were the old prehistoric Palestinians, already referred to, driven into Egypt by Semitic aggressions, or they were an Altaic people from the North, carrying with them fragments of Hittite and other populations in their march, and passing through Palestine. It would be an important revelation could anything be discovered as to their language, and this may yet be hoped for.

The influences of the Hyksos and of the war of expulsion were permanent in Egypt. Henceforth there is a great mixture of races, Ethiopian, Egyptian, and Asiatic; and the type of the royal and noble families of Egypt shows a divergence from that of the earlier times. After the Hyksos period the pure Egyptian type seems to exist only in the common people of lower and middle Egypt; and the rulers became animated by a lust of conquest and animosity against the Asiatic races not previously so evident. At the same time the government became more concentrated, and religion and social life more corrupt. The great kings of the nineteenth

as implying the holder of a battle-axe, or something cut or inscribed, as a decree, and hence a lawmaker. Og is possibly the old Turanian exclamation, "ugh," implying wonder.

dynasty, whose mummies we now have access to, (Fig. 24), have salient features of Asiatic rather than African type; and Seti, the founder of this



Fig. 24.—Head of Rameses II., the Pharaoh of the Oppression, from a photograph of his mummy now in the Boulak Museum.

dynasty, was probably a foreigner. Still, this type of face exists to-day among the Copts (Fig. 25), though by no means dominant, and in strong contrast to the old Egyptian features seen in the most ancient sculptures.

The invasion and expulsion of the Hyksos naturally lead us to think of the relations of the Egyptians with the Abrahamidæ, the children of Israel who sojourned in their country for more than two hundred years.[1] The first contact of the Hebrews with the Egyptians was when Abraham went down

[1] I take the 430 years of Moses to go back to Abraham.

into Egypt with his clan or tribe, which is usually supposed to have been in the time of the Hyksos. This is rendered the more probable by the fact that Abraham was on friendly terms with their kindred in Palestine; but Abraham's sojourn was short at this time, and it was in the days of his grandson



Fig. 25.—Head of a modern Coptic scribe, showing a type of profile resembling that of Rameses. From a drawing by Dr. Schweinfurth.

and great grandson, that the more permanent connection was established in the person of Joseph.

Huxley, I believe, says somewhere, that the Bible is the best guide-book to Egypt; and one of our Canadian boatmen on Wolseley's expedition, in writing home, expresses the same idea by saying that he thought he had walked into the pictures of an old family Bible at home, when he found himself

on the banks of the Nile. There can be no doubt that both are right, and that Egypt and Palestine, the Egyptian and the Hebrew, had much in common; and it is a curious inquiry to ask, How much did the Hebrew learn from the Egyptian, and how much the Egyptian from the Hebrew? Here we have before us that remarkable Egyptian colouring of the older books of the Bible which, as some eminent Egyptian scholars have well shown, entirely invalidates the argument of that school of critics who would assign the composition of the Pentateuch to a comparatively late date, since it is plain that Egypt, its geography, its power, its government, and its customs have, in the eyes of these writers, the same prominence which those of Assyria and Babylon have in the later books. This consideration will grow in importance under the next chapter.[1]

It would be interesting in this connection, from a scientific as well as biblical point of view, to know more than we now do of the private and social life of the common people of Egypt, among whom the Israelites so long sojourned. To this subject Maspero has recently directed attention, and we can notice not a little of home life, simple like that of the modern Egyptians, but having more comforts, and probably more cultivation of taste than that of the modern peasantry. One point alone I may here

[1] I find the Egyptian character of the Pentateuch has been well exhibited in a recent article by Poole, in the *Contemporary Review*, Sept., 1887.

note, and that is the utilization of great numbers of flowers, seeds, and fruits, wild and cultivated, as offerings to the dead (Fig. 26). The mummies of great personages were often enwrapped in long



Fig. 26.—Mummy decorated with garlands, and portion of garland of lotus petals and Persea leaves natural size (after Schweinfurth).

wreaths, most artificially prepared, of the leaves of the persea and the lotus sewn together, and forming long garlands, perhaps like the Persian ones referred to by Horace in the lines,—

"No pomp of Persian feasts for me,
No garland woven curiously
With linden bark,"

and ot which we have examples also in the Bible, not in natural flowers, but in the golden ornaments of the tabernacle and temple; though these presuppose natural garlands as used by the people. With these were flowers in their natural state, and often a great variety of things beautiful or valuable, furnished by the vegetable kingdom, and which might be supposed useful or pleasing to the spirit of the departed. Schweinfurth[1] enumerates forty-six species employed in this way in the royal and other mummies at Boulak; and in a later paper he notes a great number of useful plants buried with the humbler dead at Gehelen, near Erment, and at Abou-l-negga, near Thebes. Among others he notes the onion and garlic, which were held in high estimation in Egypt, and venerated even as Divine things, or as symbols of certain gods. The onion (*Allium Cepa*, *L.*) was largely cultivated, and is still, and also the garlic (*A. Sativum*, *L.*); and these are supposed to be the species referred to as *Bezalim* and *Chirimim* by Moses, in Leviticus xi. Besides these, however, there is found in the tombs a species of leek (*Allium Porrum.*) probably a variety of a native species (*A. ampeloprasum*, *Lin.*). Pliny remarks on the veneration of these plants in connection with oaths, and Juvenal ridicules the Egyptians for

[1] "Trans. German Bot. Society," 1882.

cultivating their gods in their gardens. With reference to the onion and the garlic, as well as to the vine, Schweinfurth speculates on the probability of the early colonists of the Nile valley having brought them from their earlier homes in the valley of the Euphrates. In any case, these plants, like the cereals and various leguminous species, were among the common inheritances of the Noachidæ before they separated to form distinct peoples; and the early agriculturists and botanical experimenters who discovered the capabilities of those plants, and developed them into useful varieties, deserved the apotheosis which was perhaps implied in the Divine honours awarded to the products of their skilful manipulation of vegetable species.

The family of Jacob was settled in the land of Goshen, in Lower Egypt,[1] and there can now be no question that this was mainly the strip of fertile land extending eastward through the desert from the Nile, near Bubastis, to L. Timsah—at one time the valley of an important branch of the Nile, perhaps in a prehistoric time of the main river, and later, in historic times, traversed by a canal now represented by the Sweetwater Canal, which carries the fresh water of the Nile as far as Suez on the Red Sea. This was for them the natural avenue of

[1] According to recent discoveries of Naville, Goshen or Gesem would seem to have been a town at the west end of the Wady Tumilat, and from which the whole district obtained its name.

an entrance into Egypt. It was and is a country of great fertility and beauty, and it has pasturage lands at the edge of the desert on each side, while it is on the main line ot commercial intercourse between Egypt and the East. I am strongly inclined to believe that the people named "Aperiu" in the Egyptian inscriptions are really the Hebrews. The fact which furnishes the strongest argument against this identification, namely, that these people are found to be in the east of Egypt after the Exodus, is, after all, not a valid objection, since it must have been that a Hebrew minority preferred the flesh-pots of Egypt, or were prevented from joining in the Exodus; and it is also possible that even after the settlement in Palestine, Hebrew prisoners, or prisoners of some of the allied races, may have been transported to Egypt, and known by this name.

Recent discoveries in Egypt have thrown much light on the Exodus, and this has more especially been the effect of Naville's great find of the site of Pithom. With the view of verifying and elucidating these important discoveries, I spent some time, when in Egypt, in studying the topography of the districts referred to in the Book of Exodus, with results which I have stated in a little work published in 1885,[1] and to which I shall refer in the following chapter, confining myself here to a short statement of the synchronism of events in Hebrew and Egyp-

[1] "Egypt and Syria, Byepaths of Bible Knowledge."

tian history, taking, however, the Hebrew genealogies and dates as a dominant guide, as they are now known to accord very closely with the more fragmentary records of the Egyptian monuments.

I have already stated the probability that the Hyksos were in Egypt in the time of Abraham. Their dominance may be roughly stated at two hundred years,[1] and Abraham may have been in Egypt many years before their final expulsion. They were succeeded by the eighteenth dynasty of native Egyptian kings; and it is not improbable that Joseph came into Egypt, and that Jacob and his family settled there in the time of Thothmes III., one of the greatest kings of this dynasty.[2] Some have supposed that the shepherds still reigned in the time of Joseph; but many things in Joseph's history make this improbable, and the chronology of the Bible accords better with that above stated. Thothmes was succeeded by Amenophis III., and after his time the remaining kings of the eighteenth dynasty seem to have deviated from the ordinary worship of Egypt, and to have introduced a Syrian worship of Aten or Adonai, the Hebrew or Semitic

[1] Manetho makes it much longer; but there is reason to doubt his correctness in this, unless he includes times of early aggression and of final retreat.

[2] If the reading by M. de Rougés of the name Iaakab, as representing a place which submitted to Thothmes in the seventh year of his reign, is correct, and if it corresponds to Jacob, then the patriarch must have been in Canaan at this time, and tributary to Egypt, before his settlement in that country.

word for Lord, and in regard to which it may be suspected that Hebrew, or at least Syrian influence had some share in its adoption. However this may be, a revolution occurred, introducing a new dynasty, the nineteenth, of which Rameses I., Seti I., and Rameses II. were the earliest kings. It was the kings of this dynasty who "knew not Joseph," and they were powerful, aggressive, military leaders, and oppressors of subject races. In the reign of Rameses II. the oppression of the Hebrews seems to have come to its height. Rameses, after a long reign, was succeeded by his son Manephtah, who reigned only eight years, and was followed for only two years by Seti II., who seems to have been displaced by a usurper, and he again, after a few years, by one Siptah,[1] who also reigned only a few years, when, according to the Harris papyrus, there occurred a great emigration from Egypt, followed by anarchy, from which Setnek I., the first king of the twentieth dynasty, rescued the nation. Somewhere in the four short reigns that succeeded Rameses, the Hebrew Exodus occurred; and one of these four kings must have been the Pharaoh who seems to have perished with his army in the Red Sea. The weakness of these kings, as evidenced by their short reigns, accords with the Hebrew story, and strong reasons have lately been advanced in favour of the belief that the Exodus Pharaoh was Siptah,

[1] Both Seti II. and Siptah seem to have been surnamed Menephtah, which has led to some confusion.

a king of whom little is known, except that he was the last king of the eighteenth dynasty; that he had a queen Ta-usen or Thuoris, who appears in some lists as the last of the dynasty, and who possibly survived him and reigned as queen; and that he left an unfinished and unoccupied tomb, from which what is known of his history has been learned.[1] Still another curious note of coincidence with Bible history is that Rameses III., of the twentieth dynasty, carried on a war in Palestine, and broke down the power of the Canaanites and other peoples of Syria at a time when Israel was in the desert; thus very effectually preparing their way.

In this chapter we have traced Egyptian history from the Laurentian age to the Exodus, and if we have been unable to extend the human period in Egypt as far back as some historians, we have more than made up for this by tracing the annals of the country back, it may be for millions of years, to the ancient Eozoic period, when, though man was not, the first animal life made its appearance on our planet. In the next chapter we must endeavour to ascertain what light modern science has thrown on the Exodus, and more especially on its topographical features.

[1] Kellog, "Princeton Lectures on Abraham, Joseph, and Moses."





View of Jebel Sufsafeh,—the Mount of the Law and the plain of Er Raheh in front of it, from a photograph of the Ordnance Survey.

The character of the mountain, as formed of old crystalline rocks, in part stratified, and its contrast with the plain, composed of recent deposits, are well exhibited by the photograph, reproduced here on a reduced scale.

CHAPTER VII.

TOPOGRAPHY OF THE EXODUS.

Modern science has approached the books of Exodus and Numbers along three lines of investigation. The higher criticism has sought to distribute their authorship among a number of writers, extending from the time of Moses to that of the later kings of Judah, and to represent the work as a compilation from different sources, made in times long posterior to those of which it treats. The writer has no inclination to enter into these questions. They are foreign to the departments of science which he has specially studied, and their value appears to him rather subjective than objective. They serve rather to show the speculative tendencies of certain minds in modern times, than to throw any actual light on the subject to which they relate. Their results are also, to all appearance, contradictory to those established by other lines of scientific inquiry. More especially they are obviously at variance with the evident intimacy of the writers with the minutest facts of the history and conditions of Egypt under the eighteenth

and nineteenth dynasties, and with the Egyptian influence in names and other particulars perceptible in these books, to whose writers Egypt is evidently the great civilized and military power ot their time, and not Syria and Assyria and Chaldea, which assume their place in the later history.

A second line of investigation, of a more promising nature, is that of archæological research, which seeks to deduce from Egyptian monuments some contemporary evidence for or against the Hebrew history. This has, in modern times, yielded valuable and positive results. We know with some certainty that the migration of Jacob into Egypt occurred either toward the close of the rule of those foreign kings known to the Egyptians as the *Hyksos*, or shepherd kings, or more probably, at the beginning of the dominancy of the native Egyptian dynasty which succeeded them, known to historians as the eighteenth. They evidently long enjoyed much consideration in Egypt, were regarded as a valuable bulwark of that country from invaders on the East, and probably furnished portions of the armies with which Thothmes III. and other great Egyptian sovereigns of that dynasty carried on their extensive and successful campaigns. It further appears that toward the close of the eighteenth dynasty the Hebrews either attained such dominance as to attempt to reform the religion of Egypt; or, what is perhaps more likely, that some astute statesman had conceived the idea of assimilating and simplifying the religious beliefs

and practices of the different races inhabiting Egypt, by one of those acts of uniformity which have so often been attempted by rulers, but with so little success. Queen Taia, said to have been a fair-complexioned woman, with foreign features, and her son Amen,—Hotep IV., or Kuen-aten,—have been handed down to us on Egyptian monuments as the leaders in this revolution; and the worship supposed to have been introduced was that of Aten or Adon, Adonai,[1] symbolized by the solar disc; one of those monotheistic religions akin at least to the patriarchal beliefs of the Hebrews. This religious innovation was followed by a time of strife and confusion, out

[1] The name Adonai (signifying Lord or "Lords" by a plural of majesty), as applied to God, first appears in the Bible in the time of Abraham (Gen. xv., xviii., xx.), who is represented as addressing God by this title; and it was no doubt in common use among the Hebrews in Egypt, since, in the interview with God at Horeb (Exod. iv. 10 and 13), Moses addresses Him by this title, so that we may class Moses himself as originally a worshipper of Adon or Aten. This name no doubt served as a common title for God to the Hebrews and Canaanites. Abimelech, king of the Philistines, for instance, uses it (Gen. xx. 4). It may also have served in the time of Joseph and of the so-called heretical king Kuen-aten, to ally the Hebrews and Egyptians religiously; and when the high-churchmen of Thebes had finally overcome this innovation, the Hebrews and many of the common people of various origins may have continued to be dissenters from the State religion, and may have still worshipped Aten or Adonai. One reason of the substitution or restoration by Divine authority of the name Jahveh, which seems to have fallen into some disuse in the patriarchal time (Exod. vi. 3), may have been to break up the connection with Egyptian ritualism and idolatry implied in the worship of Aten.

of which emerged the nineteenth Egyptian dynasty, one of the first kings of which, Seti, seems to have been himself of shepherd or Hebrew race,[1] and to have been introduced by marriage into the royal family. But with him ceased the privileges of the Hebrews. His son, Rameses II., the Sesostris of the Greeks, was a tyrant, who, through a long and mostly successful reign, ground with the direst oppression, not only the subject and foreign races, but the common people of Egypt. He seems to have been "the king who knew not Joseph" of the Bible narrative; and in the troubled reign of his successor, Menephtah, who reaped the harvest of his father's misdeeds, or in that of one of his immediate successors, occurred the Exodus of the Israelites, from which time the power of Egypt and its foreign conquests manifestly declined. From the archæological investigations which have afforded these results, much may yet be hoped which may throw light on the biblical history; and what is known tends to raise our ideas of the power and importance of the Hebrew people during their sojourn in Egypt.[2]

The third line of investigation above referred to,

[1] Under the term Hebrew I would here include all the races descended from Abraham, as the Edomites, etc. The countenance of Seti, as seen in his mummy and contemporary portraits, is certainly rather Semitic than Egyptian, and this accords with the historical statement that he was of foreign origin.

[2] For authorities see Lenormant and Chevallier, "Manual of Ancient History;" Kellog, "Lectures on Abraham," etc.

is that of topographical surveying and exploration. Much has been done in this way by successive travellers, who have traced out the probable route of the Hebrews from Egypt to Palestine, and endeavoured to identify the sites of the greater events of the Exodus; but these investigations have for the most part been so hasty and imperfect, that the greatest doubts have rested on the subject, and that even the precise site of the Mountain of the Law has been a matter of controversy. Recently, however, owing to the liberality of a number of gentlemen interested in geographical and biblical research, a thorough topographical survey of some of the more important parts of the peninsula of Sinai has been made by officers of the British Ordnance Survey; and, probably for the first time since the Exodus, a party of skilled surveyors has followed on the track of the Israelites, and subjected the whole question to the test of accurate measurement. The results of this survey have been most interesting and important, and have been sumptuously published in four folio volumes of letterpress, maps, and photographs; which picture, in a manner never before accomplished, that wilderness into which the ancient Hebrews plunged themselves in quest of civil and religious liberty.[1]

Still more recently, the happy discovery and ex-

[1] "Ordnance Survey of the Peninsula of Sinai," published by authority of the Lords Commissioners of Her Majesty's Treasury, Ordnance Survey Office, Southampton, 1869.

ploration of the site of Pithom, by M. Naville. under the auspices of the Egypt Exploration Fund,[1] has thrown a flood of light on the earlier stages of the Exodus, not comprehended in the scope of the Ordnance Survey, and the topography of the Wady Tumilat, now recognised as the ancient land of Goshen, has been admirably illustrated by the labours of Colonel Ardagh and the engineers of the English army of occupation. Under the stimulus of the Pithom discovery, I gave some days of the time at my disposal to an examination of the ground between Cairo and Ismailia, and thence southward to Suez and Jebel Attaka,—a district now very accessible by means of the railway between Cairo and Suez,—with the view of carefully weighing in the light of this discovery, and of the actual conformation of the ground, the probable route of Israel.

On the east side of the Delta of the Nile, about fifty miles north-east of Cairo, a narrow valley of cultivated soil extends eastward, with desert on both sides, for about eighty miles, or nearly as far as the town of Ismailia, on the line of the Suez Canal where it crosses Lake Timsah. This valley, known as Wady Tumilat, and anciently as the land of Goshen, or Gesen, or Rameses, is wide at its western end, and gradually narrows towards the east. As the desert sand is, however, encroaching on it from the south, and has, indeed, in places overwhelmed an ancient canal which at one time probably ran

[1] See also Naville's later volume, "Goshen."

near the middle of the valley, it must formerly have been more extensive than at present. Recent surveys also render it certain that this valley once carried a branch of the Nile, which discharged its waters into the Red Sea. This branch, or a canal representing it, must have existed in the time of Moses. At present the valley is watered by the Sweetwater Canal, running from the Nile to Suez; and though probably inferior to the land of Goshen in its best days, it is still one of the most beautiful districts in Egypt, at least in its western part, presenting large stretches of fertile land covered with luxuriant crops, numerous cattle and sheep, large groves of date-palms, whose fruit is said to be the best in Egypt, and numerous populous villages; while it must always have been, what it now eminently is, a leading line of communication between Egypt and the countries to the east.

The relations of this valley accord admirably with the scriptural notices of it. It would be the only way of convenient entrance into Egypt for Jacob with his flocks and herds. It was separated to a great degree from the rest of Egypt, and was eminently suited to be the residence of a pastoral and agricultural people, differing in their habits from the Egyptians, and accustomed to the modes of life in use in Palestine. Possibly it may have been thinly peopled at the time, owing to the then recent expulsion of the Hyksos. The wonder is, that the Israelites could have been induced voluntarily to

leave so fine a country for the desert; and this can be accounted for only by the galling nature of the oppression which they were suffering. It is certain also that, before the time of the Exodus, the Hebrews must have spread themselves, to some extent, in Lower Egypt. This is apparent from the offices assigned by Pharaoh to the brothers of Joseph, and from the fact that the mother of Moses resided near the court of the king, probably in Zoan or its vicinity (see map, Fig. 27).

Such being the theatre of the events recorded in the early chapters of Exodus, the time was in the reign of Menephtah, or of Siptah, or some one of the four short-lived kings who succeeded to the long and iron reign of Rameses II.; and the court of the Pharaoh was held at the ancient city of Zoan, or Tanis, about twenty miles north of the Wady Tumilat, and near the northern margin of the Delta. We know from contemporary Egyptian sources that it was not unusual for the Egyptian kings at this period to reside at Zoan, especially when they had affairs of state in hand with the Semitic peoples in the Delta, or with the subject provinces in Western Asia. At the time in question the disaffection of the Hebrews was itself a good reason for the royal residence being fixed at this place.

Zoan was a town having historic associations with the Hebrews. It was built, presumably, by an Asiatic (possibly Hittite or Anakim) colony seven years after Hebron; and this note in the Book of



Fig. 27.—Shaded portion desert, unshaded Nile Alluvium. (From "Egypt and Syria.")

Numbers[1] constitutes an intimation to us that while the Egyptians were occupying the Delta from the south, other peoples were pressing into it from the east. It had probably been the capital of the Hyksos Pharaoh who so hospitably received Abraham when driven by famine into Egypt. It had not unlikely been the head-quarters of Joseph when providing for the seven years of famine. Its ruins, so well excavated and described by Petrie,[2] show that, though built on a mere sandhill in one of the lowest parts of the Delta, now, by the gradual settling which is taking place, almost submerged, it was one of the most magnificent cities of Egypt in its public buildings; and we know that it was the centre of a district thickly peopled, and of exuberant fertility and great agricultural beauty, even as the "Garden of the Lord." The following graphic description of it, by Miss Edwards,[3] may give some idea of the city to which Moses was sent on his mission of deliverance, and may enable us better to sympathize with his hesitation in accepting such a commission:—

"Let us suppose a stranger to have hired a skiff a mile or two below Tanis, and to approach by way of the river. The banks are bordered by gardens and villas, and the stream is alive with traffic. He is put ashore at the foot of a magnificent flight of

[1] Numbers xiii. 22.

[2] Report on Tanis, Egypt Exploration Fund.

[3] *Harper's Magazine*, 1886.

steps, from the top of which he sees the great temple —a huge pile of buildings showing high above a line of massive wall. It stands on the east bank of the Nile, facing westward. A paved roadway leads from the landing-place to the gateway. This pile of buildings—more like a huge fortress than a temple—looks quite near; but it is full half a mile from the water-side. Around it, beyond it, lies a flat, verdant, limitless panorama, divided by the broad river. This plain is dotted with villages, each embowered in clumps of sycamores and palms. Here and there a gliding sail betrays the course of an unseen canal, while far away to the northward, whence a mass of storm-cloud is driving up from the coast, a pallid, far-distant gleam tells the story of the sea. As yet there is no Lake Menzaleh; as yet there is no desert. The great natural dike which shuts out the waters of the Mediterranean on the one hand is still intact; the bounteous Nile is not yet canalized on the other. A time will come when the one shall be let in and the other shall be barred out, but for the present all is corn-land and meadow grass where hereafter there shall be salt lake and sand.

"Even at this distance the stranger's quick sight detects the tops of a forest of tapering obelisks, and the twin towers of a series of massive pylons. One object, shining, solitary, towering high above the temple and its surroundings, fixes his attention. It is ruddy, as if touched by sunset; it glitters, as

though the surface were of glass. It is not an obelisk; neither is it a tower. It cannot be a statue; that is impossible. Yet, as he draws nearer, his shadow lengthening before him, the paved dromos blinding white beneath his feet, that glowing, glittering, perplexing thing grows more distinct, more shapely, more like that into which it presently resolves itself—a godlike, gigantic figure, crowned, erect, majestic, watching over the temple and the city." (This is the great monolithic granite statue of Rameses II.) "A single figure fourteen times the height of the living man—a single figure cut from a single stone of the precious red granite of Syene.

"The giant stands alone, not in the middle, but to the side of a large courtyard, so leaving an unbroken vista from the door of the first pylon to the door of the sanctuary. His attitude is that of walking, with the left foot forward. His right hand grasps a short truncheon, his left holds a massive staff of state. The face is serene and noble, and on the head towers high the double crown of Upper and Lower Egypt. The figure alone, with its crown, stands over 90 feet in height, and weighs at the least 900 tons. Crown, plinth, and pedestal all counted, it stands 120 feet above the level of the pavement. After this, no miracle of art, no pomp of decoration, can greatly move the wonder of the pilgrim stranger. He goes on through a courtyard surrounded by a colonnade, and bisected by an avenue of single-stone columns thirty-six feet high;

thence through another gateway, across an open space, and along a magnificent avenue bordered on both sides by monuments of many kinds and many ages. This avenue is the *Via Sacra* of Tanis. It is about 375 feet in length, and within that comparatively short distance, arranged so as to produce the subtlest play of colour and the greatest diversity of effect, are ranged a multitude of red granite obelisks, yellow sandstone colossi, portrait statues in red, black, and grey granite, shrines, sphinxes, and doubtless many smaller works in the more rare materials, such as diorite, alabaster, green serpentine, and the like."

But Moses, strong in faith and fortified by Divine promises, dared to enter on his great mission and to act as the intermediary between the oppressed, discontented, yet fickle and uncertain multitude, and the great king, strong in his well-organized army and in the support of the nobles and priesthood of Egypt.

It would seem that the Hebrews had so far acquiesced in the counsels of their leaders as to assume an attitude of passive resistance, and had probably gathered around the city of Rameses and in its vicinity, a most convenient rallying-place, both for those in the land of Goshen and those scattered over other parts of Egypt. There seems little reason to doubt that this Rameses was not, as some have supposed, Zoan itself, though that city has sometimes

been called by the name Rameses, but a store city or garrison town at the western end of the Wady Tumilat, at or near the places now called Abou Hamad and Saftel Henneh.

Moses and Aaron passed to and fro between Zoan and Rameses, acting as ambassadors of their people, and it is evident that this state of things continued for some time, neither party venturing to take a decisive step. The reason of this it is not difficult to understand. The king's chariot force, and probably other troops assembled at or near Zoan, commanded the land of Goshen. Any movement of retreat to the east on the part of the Hebrews could be checked by an advance on their flank. The Hebrews, therefore, could not move without the king's consent. Knowing this, and knowing also that the beginning of actual civil war might be the signal for rebellion among other subject Asiatic peoples, the king thought it best to temporize. It seems also very probable that the invasions of enemies from the west, which we know occurred in the reign of Menephtah, had obliged the king to deplete or remove his garrisons on the eastern side of Egypt, thus giving a comparatively easy means of departure to the Israelites. Some such supposition seems necessary to account for the attitude taken up by the fugitives and the policy of the king. In such cases of political deadlock, Divine Providence often cuts the knot. It was so in this instance.

The continued plagues inflicted on Egypt at length

produced such discontent among the people that the king was forced to let the Hebrews go. The mandate was no sooner given than it was acted on at once and in haste. It was in anticipation of this that the people had been collected, and it is with reference to this that they are said to have been driven out at the last. No time was to be lost, for if Pharaoh should change his mind, he still had the Israelites in his power for two days' march at least. Beyond that, they might hope to be out of his reach.

The camp at Rameses was therefore broken up; and, gathering their countrymen, and their flocks and herds as they passed along the Wady Tumilat, and receiving from the Egyptians gifts and contributions in lieu of the property they had to leave behind, the host hurried on to the eastward, executing apparently in one day a march of twelve to fifteen miles; though perhaps it is not necessary to suppose that the several halting-places were merely at the end of single day's marches. They are said to have reached the district of Succoth, and to have encamped within its limits, probably to the west of Pithom; and there is no more likely place for this encampment than the neighbourhood of Kassassin, where there is abundance of forage and water, and a defensible position, reasons which weighed in our own time with Sir Garnet Wolseley in selecting this as a halting-point in his march on Tel-el-Kebir. Meeting with no molestation or pursuit, they continued

their march on the following day, and encamped at Etham, on the edge of the desert, or on the edge of the desert of Etham, at the eastern end of the Wady Tumilat. We learn from Numbers xxxiii. 8 that all the desert east of the present Suez Canal was called the desert of Etham ; and the "edge" of this desert on the route followed by the Israelites must have been near the present town of Ismailia, at the head of Lake Timsah, then perhaps truly a lake of crocodiles, as its name imports, and sweetened by the waters of the Nile.

Probably the encampment was not far from the present Nefish station, a little west of the town of Ismailia ; and it is worthy of note that here the desert presents, in consequence of its slight elevation above the bottom of the wady, a better defined "edge" than usual. From elevated portions of the desert surface at this place the bold front of Jebel Attaka can be seen in the distance, with the intervening lower range of Jebel Geneffeh, and the green and now partly swampy flat of Wady Tumilat in the foreground. When at Ismailia we rode over this ground, and could imagine the Hebrew leader looking out from the sand-hills behind his encampment with anxious eyes to the east and south, where his alternative lines of march lay, and to the west, whence Pharaoh's chariots might be expected to follow him.

At this point the desert portion of the journey direct to Palestine begins ; and here, between Lake

Timsah and Lake Ballat, is the highest part of the isthmus, that now called El Guisr, and in some places eighty feet above the sea, and the best road out of Egypt to the east. Here the people would be for the moment safe. Pharaoh could no longer attack them in flank; and if he approached from the west, a few resolute men could hold him in check, while the rest should flee eastward into the desert.

But here a new and at first sight strange order is given to the fugitives. They are not to go any farther eastward in what seems the direct road to Canaan, lest, as we are told, when opposed by the Philistines,—at this time subject to or allied with Egypt,—they should not have courage to advance. They are to turn to the south, at right angles to their former course, along the west side of Lake Timsah and the Bitter Lakes, the latter then probably the northern end of the Yam Suph or Red Sea. This would have the temporary advantage of keeping them a little longer within reach of water and pasturage; but, if Pharaoh should pursue them, it would interpose the sea between them and their objective point, and enable their enemy to cut off their retreat northward, and shut them in between his army and the Red Sea, that is, if the Red Sea then extended up into the Bitter Lakes, which we shall see in the sequel is probable; for if there had been a pass south of the Bitter Lakes, at Chalouf, as at present, there could have been no difficulty. The only explanation of the order given to Moses is, that

by this movement, "God will be honoured on Pharaoh and his host," while Pharaoh himself obviously thought that the fugitives had involved themselves in inextricable difficulty, and that the wilderness had shut them in, or driven them to this suicidal course.

It is to be observed that in executing this apparently retrograde movement, the Hebrew leader may be supposed, as heretofore, to have have had in view the wisest means to protect his people from sudden attack, and to have acted without reference to any possible miracle. In moving to the south his flank would again be exposed for a time, but in the course of a few miles he would enter the narrow pass between the elevation known as Jebel Geneffeh and the Bitter Lake, and would again be protected on both flanks against the attack of a chariot force. This position of vantage he might reach in one day's march, and beyond this he would still be protected for several miles, until the flat country opens out into the desert of Suez, and he would again be exposed to attack from the west, and would besides be in a district destitute of water. There can therefore be little doubt that he must have halted somewhere in the narrow plain between Geneffeh and the Bitter Lake, where he could hope for a time to make a stand against his pursuer and wait the development of events. Here accordingly, as we are informed in the narrative, at the close of the day's march in the evening, the chariots of Pharaoh were seen advancing in

pursuit. Pharaoh had no doubt watched by scouts the march of the Israelites, and when he learned that they had turned to the south he at once decided to pursue them, interpreting their change of direction as caused by dread of the desert, which had "shut them in," and judging that, hemmed in by the sea, they were entirely at his mercy.

A very grave and serious responsibility was now upon the leader of the Exodus. He had, it is true, passed over the perilous open country between Etham and the defile of Geneffeh; but here he must make a stand. If he could repel the attack of Pharaoh, protected as his flanks were by the sea on one side and the mountains on the other, he might hope to gain time to transport his people over the narrowest part of the sea to the south. But if he failed in this, he would be driven into the open and waterless desert to the southward, and would be at the mercy of his foe, unless he could force his march thirty miles farther, and take up a position on the heights of Jebel Attaka, where, however, he would be destitute of water. But the children of Israel were in no mood to fight for their liberty; and it appears from Exodus xiv. that they were prepared rather to surrender and return to Egypt. Moses remonstrated, and assured them that the Lord would fight for them; and it is implied in the narrative that they were urged to defend themselves; but it was of no avail, and when he "cried unto the Lord" the order was given to plunge into the sea and cross it. The

people who would not fight were willing to flee, even into the depths of the sea. They had faith in God as the ruler of nature and as the God of their fathers, though their long bondage had made them cowards as regarded the Egyptians; and their faith was rewarded by a miraculous passage, in regard to which a "strong east wind," driving the waters before it, is especially mentioned as a secondary cause. This was in all probability a north-east wind rather than due east, and, co-operating with a receding tide, would tend to produce an unusual recession of the waters. But here arise several questions which deserve our attention. Before attending to these, however, let us summarize the narratives in Exodus and Numbers, that we may fully understand the movements of the Hebrews and the strategy of their leader, as above described.

The command to depart was given by Pharaoh "in the night," and the people were "thrust out, and could not tarry," so that they broke up early the next morning. "And the children of Israel journeyed from Rameses to Succoth, about 600,000 men, besides children"; and a "mixed multitude" of Egyptian slaves went with them. They "pitched in Succoth," that is, within the boundary of that district. "They departed from Succoth, and pitched in Etham, which is in the edge of the wilderness" of the same name. But God led them not "the way of the land of the Philistines," "lest peradventure the people repent when they see war, and they

return to Egypt. But God led the people about, the way of the wilderness of the Red Sea. So they were commanded to "turn" or "turn back," and to march to "Pi-hahiroth," which is near the sea "between Migdol and the sea," or "before Migdol," and "over against" or opposite to "Baal-zephon," which was probably on the opposite side of the sea. Here it was that the Egyptians came upon them.

A preliminary question here is, as to the cause of the despair of the Hebrews, when they found that they were pursued. The force employed against them was not very large. It is stated as six hundred chariots, each probably carrying two men. It must, however, be borne in mind that this kind of force was the most formidable known at the time, and that the Egyptians were accustomed with it to rout great hosts of half-disciplined and poorly-armed infantry. It was also, in all probability, only the advance guard of a much larger army, and intended to bring the Israelites to bay until the Egyptian infantry could close upon them. There was cause therefore for alarm, though Moses had evidently at every stage of the march selected positions suited to give his army, if it may be so called, the greatest possible advantage.

A still more important question is as to the precise point where the Hebrews were overtaken, and where the crossing of the sea occurred. It is evident, in the first place, that no important town or city existed at the locality. This is implied in the description

given, and in the character of the names employed. The place of this great event was so important that care was taken to define it by mentioning three points, presumably well known to the narrator; but this method implies that there was no one definite name for the locality. All the names employed are Semitic, and not Egyptian, except perhaps the prefix "Pi" in one of them. Pi-hahiroth may have been a village, but its distinctive character is that of "place of reeds"—a reedy border of the sea, perhaps near the embouchure of fresh water from the Nile,* or Sweetwater Canal. Naville conjecturally identifies it with a town named Pikerehet, not far from Pithom, where there was a temple of Osiris, and a "farm" of the Egyptian king. It seems to have been nearer the sea than Pithom, and a place of grass, reeds, or pasturage. This may perhaps account for the fact that the Septuagint translates Pi-hahiroth by the words "the farm," that is, probably, the farm of Pharaoh, the same, perhaps, in which Joseph's brethren had been appointed overseers, and which may have continued under the management of Hebrews. But "τῆς ἐπαυλέως" of the Septuagint perhaps rather means a fold for cattle, such as would be connected with pasture lands, than a farm. Migdol cannot have been, as supposed by some, a fortified place. It would have been madness, with Pharaoh in their rear, for the Israelites to have encamped near such a place. It must rather have been a commanding height, used, as the name implies, as a watch-tower, to command

an extensive view or to give signals. It is stated by some writers that there were many Migdols or watch-towers on the Egyptian frontier, which is probably true, but this must have been an object, and probably a natural one, sufficiently conspicuous and prominent to fix the locality in the time of the writer. Baal-zephon—"the Lord of the North"—is generally understood to have been a mountain, though both Jebel Attaka and the northern peak of Jebel-er-Rabah may lay claim to the title. In any case, the place so named by Moses was "opposite" to the camp of the Israelites, and consequently across the sea. And not unlikely it was a high place sacred to some Semitic god, for the name Baal implies a Semitic rather than Egyptian divinity.

After somewhat careful examination of the country, I believe that only one place can be found to satisfy these conditions of the Mosaic narrative, namely, the south part of the Bitter Lake, between station Fayid on the railway and station Geneffeh. Near this place are some inconsiderable ancient ruins, and flats covered with *Arundo* and *Scirpus*, which may represent Pi-hahiroth. On the west is the very conspicuous peak known as Jebel Shebremet, more than 500 feet high, commanding a very wide prospect, and forming a most conspicuous object to the traveller approaching from the north. Opposite, in the Arabian desert, rises the prominent northern point of the Jebel-er-Rabah, marked on the maps as Jebel Mukshcih, and which may have been the

Baal-zephon of Moses. Here there is also a basin-like plain, suitable for an encampment, and at its north side the foot of Jebel Shebremet juts out so as to form a narrow pass, easy of defence. Here also the Bitter Lake narrows, and its shallower part begins, and a north-east wind, combined with a low tide, would produce the greatest possible effect in lowering the water.[1]

It may further be observed as an incidental corroboration, that the narrative in Exodus states that after crossing the sea the Israelites journeyed three days and found no water. From the place above referred to, three days' journey would bring them to the Wells of Moses, opposite Suez, which thus come properly into place as the Marah of the narrative, whereas the ordinary theory of a crossing at Suez would bring the people at once to these wells. They are also said to have journeyed for three days in the wilderness of Etham, and then to have come to the wilderness of Shur, or "the wall," whereas the wilderness of Shur is directly opposite Suez, and not three

[1] It has been suggested that the strong north-east wind occurring with an ebb tide, may have laid bare one of the sand-banks crossing the head of the gulf, forming a road for the people, while the water on both sides protected their flanks as a wall of defence. A change of wind to the west, immediately following their passage, would bring back the waters on their enemies; and that this change actually took place is shown by the fact, stated in Exodus, that the bodies of the Egyptians were cast up on the east side of the sea, which could only have taken place with a west wind.

days' journey to the south. The three days' journey from the place of crossing would not be long journeys, the whole distance being about thirty miles; but there was now no reason for haste, and the want of water would not be favourable to long marches.

The question has often been raised whether, at the time of the Exodus, the Red Sea extended farther

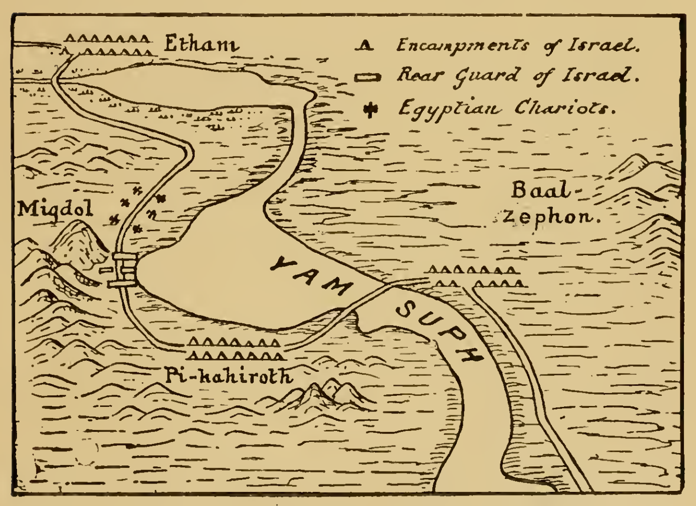


Fig. 28.—Bird's-eye View illustrating the Crossing of the Red Sea.

north than at present. In answer to this, it may be stated, in the first place, that the terms of the narrative in Exodus imply, and the geological structure of the country proves, that there must have been a land connection between Africa and Asia north of Ismailia, at the place which is now the highest point of the isthmus. Further, without entering into de-

tails, I may say that there are some geological reasons for the belief that there has been in modern times a slight elevation of the isthmus on the south side, and probably a slight depression on the north side. It seems also certain that in the time of Moses a large volume of Nile water was during the inundation sent eastward toward the Red Sea. There is therefore nothing unreasonable in supposing that, as assumed in this chapter, the Bitter Lakes at the time of the Exodus constituted an extension of the sea. Further, such an extension would be subject to considerable fluctuations of level, occasioned by the winds and tides. These now occur towards the head of the sea. Near Suez I passed over large surfaces of desert, which I was told were inundated on occasion of high tides and easterly winds, and at levels which the sea now fails to reach there are sands holding recent marine shells in such a state of preservation that not many centuries may have elapsed since they were in the bottom of the sea. Since my return to England I have found that Professor Hull takes nearly the same view with reference to the condition of the isthmus at the time of the Exodus, which has also been advocated by Ritter, and by Mr. Stuart Poole. M. Naville favours a locality still farther north, between the Bitter Lakes and Lake Timsah. Not being aware of this when on the ground, I did not give any special attention to this as a crossing-place; and the only objection to it seems to be, that it is too near to the encampment at

Etham, and too far from the Wells of Moses to accord exactly with the narrative in Exodus. Naville quotes Linant Bey as favouring this view on different grounds from himself.

Finally, to fulfil the precise conditions of the story of the fourth chapter of Exodus, we must go one day's march southward from the edge of the desert near Ismailia, and halt in front of an eminence with or serving as a watch-tower, with Pharaoh's pastures and cattle-folds in front, and the mountain shrine of Baal-zephon exactly opposite on the east side of the sea. We shall then be in a position to march straight forward to the crossing-place. I believe these conditions are most fully realized at the south end of the Bitter Lakes, near Jebel Shebremet, but they may possibly also be approximated by the line south of Lake Timsah, suggested by M. Naville.

In the above narrative of the Exodus, which is in the main identical with those given in my work, "Egypt and Syria,"[1] I have stated in the briefest possible way the conclusions at which I arrived on the ground as to the movements of the Israelites; but as very different views as to the place of the crossing of the Red Sea have been advocated, I think it necessary here to take up the subject a little more in detail under the following heads:—(1) The structure and present state of the Isthmus of Suez, and the changes which it has experienced in historical times. (2) The historical evidence as

[1] Religious Tract Society (2nd edition, 1887).

to a former greater extension northward of the Red Sea.

The facts relating to the movement of Israel from Egypt to Palestine render necessary some reference to the structure of the Isthmus of Suez, respecting which and its existence at various periods as a connecting link between Asia and Africa, there have at different times been very diverse opinions. Perhaps the best way to understand its nature will be to suppose it reduced to its condition in former geological periods, as explained in the previous chapter, and to note the changes which it must have undergone. If we suppose Egypt, Arabia, and Palestine reduced to the land of which we have evidence in the Mesozoic or early Tertiary age, it will appear as three rocky islands, with fringing belts of sand, and two straits connecting what are now the Red Sea and the Mediterranean. In the cretaceous time, when the great limestones of Palestine were deposited in the sea, and when the similar limestones of Egypt were also formed, this was the condition of the land, and this continued substantially to the Eocene period; but at the close of this, the eastern strait, that of the Gulf of Akaba, became closed. The western strait, that of which the Gulf of Suez is a part, continued through the Miocene; and if the raised beaches, already referred to, near Cairo, are of Pliocene or Pleistocene date, then up to this time there must have been free communication between the Red Sea and the Mediterranean, though probably

with an interval of land in the Pliocene. In evidence of this, we have shells identical with or near to those of the Indian Ocean, in the raised beaches at Cairo and Gizeh. The present isthmus is, therefore, a very modern thing; and it can scarcely have existed earlier than the first Continental period of the Pliocene. But at this time the isthmus must have attained to a great development, and some cause must have obstructed the issue of the Nile into the Mediterranean, for we find extensive deposits of marly beds of lacustrine origin containing Nile shells, one of them, *Ætheria caillaudi*, now confined to the Nile above Assouan, and bones of hippopotamus, crocodiles, and fishes belonging to the Nile.[1] There must, in short, have been a sort of lake or lagoon where the isthmus is now. (See maps.)

At this time, no doubt, the separation of the Mediterranean fauna from that of the Indian Ocean and Red Sea began, and would be accelerated by the different temperature of their waters, established so soon as the isthmus was formed. But the great Pleistocene submergence next occurred, and again the waters of the Red Sea and Mediterranean probably intermixed freely for a time. This was succeeded by a re-elevation, partially restoring the conditions of the first Continental period, and finally connecting Asia and Africa. It may be that the

[1] Schweinfurth describes the freshwater beds around Lake Timsah as indicating an old mouth of the Nile.

duration of the Pleistocene submergence was not long, so that little time may have been given for mixture of faunæ. But in any case, so soon as the isthmus was re-established, there would be a divergence, because the Red Sea is supplied with the warm waters of the Indian Ocean, and the Mediterranean with the cooler waters of the Atlantic. For this reason the Indian Ocean fauna reaches up to the head of the Red Sea, and the Atlantic fauna to the head of the Mediterranean. We have already seen that there is no necessity whatever for supposing that the shells of the two seas have been modified since the isthmus was established; the question is one not of modification, but of migration. Certain it is that at present the shell-fishes of the Red Sea are quite distinct from those of the Mediterranean, and nothing can be more curious than to gather the beautiful Indian Ocean shells and corals so abundant about Suez, and then to go over to Port Said and note the entire difference of the Mediterranean animals. It has been said, that a geologist studying the beds now being deposited in the Mediterranean and Red Sea, would consider them to belong to different geological periods by reason of the difference of the shells; but this would be the case only if he were ignorant of the geographical conditions, and also of the contemporary animals and plants of the land.

Let us now look at this curious isthmus, thus singularly built up to unite Asia and Africa, with

the aid of the section (Fig. 29). It will thus be seen that the oldest part of the isthmus is formed of the Miocene beds at Chalouf, near the head of the Red Sea, which are not, however, now more than two or three yards above that sea, and which are covered in part by old Nile deposits and in part by sands, with shells of Red Sea species. The highest part of the isthmus, however, and that which may in historical times be called its original part, is that of the rising grounds of El Guisr and the Serapeum, which are composed of old Nile deposits. Thus it would seem that the Nile, before it began to build up its own delta, was occupied in filling up the strait between Africa and Asia, and in constructing that isthmus which in our time M. de Lesseps has cut through.



Fig. 29.—Section of the Isthmus of Suez.—(a) Modern Deposits with Mediterranean shells. (b) Modern Deposits with Red Sea Shells. (c) Isthmian Deposits (Pleistocene). (d) Miocene Tertiary.

With reference to the former extension westward of the Gulf of Suez, we have indisputable evidence in the marine beds with Red Sea shells extending toward the Bitter Lakes; and at a very slight elevation above the present

level of the sea, not, I believe, anywhere exceeding twenty-seven feet along the line of the canal. These shells are of recent Red Sea species, and therefore belong to the time succeeding the Pleistocene submergence, that is, to the early modern period. It is true that the oldest rock known along the line of the canal exists at Chalouf, near the present head of the sea, and that the ridge cut by the canal is twenty-six feet above the sea; but of this only the lower part consists of the Miocene beds, the upper part being modern; and the evidence of the shells and raised beaches shows that in the early modern period this ridge must have been lower than the sea-level, that is, there has been modern elevation.[1]

The question to what extent this condition of extension of the Red Sea existed at the time of the Exodus is one depending on the historical evidence, to which we may now turn, beginning with the great fact on which the whole hangs, the identification of Pithom by M. Naville.

The site of Pithom is distinctly visible from the railway, about twelve miles west of Ismailia, and presents the remains of fortifications and extensive granaries of crude brick, some portions of which probably date from before the Exodus, though the site was occupied down to Roman times as the chief town of Succoth, and an important frontier post. During the construction of the Sweetwater Canal,

[1] For further facts see Prof. Hull's Report to Palestine Exploration Fund.

it was also selected as a principal station, and at present it is occupied by Arabs, who cultivate the ground in its vicinity. It possessed a temple to the god Ra in his aspect of Tum in which he represents the setting sun, erected by Rameses II.,[1] and some of the objects connected with this temple exist in a remarkable state of perfection, and are of great interest as monuments contemporary with the residence of Israel in Egypt, and in the transport and placing of which the Hebrew bondsmen were no doubt employed. Among those transferred to the square of Ismailia, and accessible to every traveller, are three sitting figures in Syene granite, rather larger than life. The central one is Rameses him self, and the gods Ra and Tum sit at either side. There is also a monumental stone of the same granite, inscribed with the record of the building of the temple, a monolithic sanctuary and sphinx, cut in the brown quartzite of Jebel Ahmar, and two large sphinxes in the porphyritic diorite of Assouan. All these objects are in the best style of the art of the nineteenth dynasty, and, as set up in one of the chief cities of Goshen, were badges of the subjection of the Hebrews to the king and to his gods.

But Pithom existed long after the time of Rameses, and is shown by the inscriptions discovered by Naville to have been an important garrison town in the Greek and Roman times, and to have been identical with a town known as Heroö-

[1] The name "Pithom" represents Pi Tum, the abode of Tum.

polis in those times, and whose site was previously unknown. Now, as Naville has shown, Heroöpolis was a town described by many ancient authorities as near to the Arabian Gulf, and as eight and three-quarters or nine miles from a seaport on that gulf known as Clysma, and he actually found a Roman milestone which indicated this distance from Clysma. All this has been puzzling to geographers, and will continue to be so till they admit the former northern extension of the Red Sea, even in historic times. The whole argument of M. Naville is well summed up in the following extract from a paper by Professor Gillett of New York.

"The importance of the milestone which Naville found, and which gives the distance from Ero or Heroöpolis to Clysma as nine miles, has been questioned. According to the testimony of ancient geographers, Clysma was a port on the Red Sea at its upper end. If, then, the sea extended north of Suez and included Lake Timsah, the place must have been situated near that lake. When this arm of the sea was dried in part by the rising of the ground at the south of the isthmus, the head of navigation was transferred, and with it the Red Sea port, which thus carried the name southward with the trade and fame. Thus, on this theory, the milestone bears witness to the nearness of the sea.

"In his geography mention is made of the city of Heroöpolis by Strabo, of which he says (Book xvi., ch. iv., § 2, and xvii., iii. 20) that it was 'situated

in that recess of the Arabian Gulf which is on the side of the Nile' (toward the Nile); and incidentally he speaks (xvi., iv. 4, 5) of those who sail from Heroöpolis to Ptolemaïs. In the same work he says (xvii., i. 26), 'Near Arsinoë are situated, in the recess of the Arabian Gulf toward Egypt, Heroöpolis and Cleopatris; harbours, suburbs, many canals and lakes are also near.' In another place he speaks of the sea as the 'Heroöpolitan Gulf.' Now the distance of the site of Heroöpolis from the sea is sixty miles or so; and if the sea never came nearer we must take the choice between two, either the milestone and Strabo pervert the truth (without any motive, or through ignorance), or we have no clue as yet to the location of the ancient Heroöpolis. What would be the sense of calling a harbour after the name of a city sixty miles distant, across an arid plain, and with which it had no connection by water? and how could so circumstantial a recorder of travels as Strabo be so far mistaken as to speak of 'sailing from Heroöpolis'? The question is really a simple one on the single assumption that formerly the sea came farther north, and has been dried or driven back by the rising of the ground, which has cut off the present Bitter Lakes and Lake Timsah. This would harmonize all statements of Strabo, the milestone, and the Septuagint and Koptic versions of the Bible. It is a peculiar fact, that the Septuagint (Gen. xlvi. 28) says that Jacob met Joseph at Heroöpolis, while the Koptic version gives Pithom as the place of meeting.

If, now, as the work of Naville shows, Pithom and Heroöpolis were one and the same place, it is a striking proof of the correctness of the men who made the versions."

There are some further correlations of the geological with the historical evidence, which are deserving of notice. The modern shells on the south side of the height north of Ismailia, show a recent extension of the Red Sea on the south, while at the same time there is evidence that the whole northern side of the isthmus has been subsiding, and that districts formerly cultivable, are now under the waters of Lake Menzaleh. Nothing is more illustrative of this than the present state of the once beautiful district around Zoan. I am indebted for the following evidence of this to a paper by Miss Edwards, already quoted. She quotes the following passage from Mas'oudy, an Arab traveller and historian of the tenth century, with reference to Lake Menzaleh.

"The place occupied by the lake was formerly a district which had not its equal in Egypt for fine air, fertility, and wealth. Gardens, plantations of palms and other trees, vines, and cultivated fields met the eye in every direction. In short, there was not a province in Egypt, except the Fayoum, to be compared with it for beauty. This district was distant about one day's journey from the sea. . . . But in the year 251 of the era of Diocletian (A.D. 535) the waters of the sea flowed in and submerged that part of the plain which now is called the Lake of

Tennis; and every year the inundation increased, so that at last it covered the whole province. All the towns which were in the lowest levels were destroyed, and only those which were built on rising grounds remained unharmed. The total submersion of this part took place one hundred years before the conquest of Egypt.

"Thus," adds Miss Edwards, "the whole face of the country was changed, and the rich flats across which the Great Colossus had been visible from afar off in the palmy days of Tanis, were again devoured by that same hungry sea from which nature had reclaimed them, inch by inch, in ages long past. As time went on, the towns thus islanded in an unhealthy lagoon languished, were deserted, and became the haunts of myriads of wild-fowl. Meanwhile, the vapours from this vast foul lake poisoned and blighted the vegetation of the surrounding country, which has been finally ruined by the canalization of the river, and the shutting off of the annual inundation. Now all is desolate—a province laid waste, a temple in ruins, a city in ashes; on the one hand, a wilderness of waters; on the other, a wilderness of desert. 'The rest is silence.'"

This is perfectly natural. The delta has been built up by successive additions of mud derived from Egypt and interior Africa, as we have already seen; while no such depositions have been going on in the Red Sea basin. All such areas of great deposition tend to be areas of subsidence, so that while

they gain by additions on their surface, they lose by settlement, sometimes gradual, sometimes suddenly started by earthquakes. In this way the high land of El Guisr has, in modern times, been the axis on which the isthmus has revolved, the south side rising, the north side sinking.

The history of the Wady Tumilat itself confirms this conclusion. The maps of the military engineers show conclusively what a geological traveller can see for himself, that the Wady Tumilat once carried an important branch of the Nile to the Lake Timsah and the Red Sea. Silting up and elevation to the south had been diminishing this even before the time of Moses; and we find at that very era Seti I. and Rameses II. re-establishing the communication by a canal. Still later, this work had to be done over again by Necho and later Egyptian kings, by Darius in Persian times, by the Ptolemies, and by Hadrian in the Roman time. All this testifies to the increasing difficulty of keeping up this communication, until at length the latest canal had to be carried all the way to Suez. It is not unlikely that this elevation is still in progress, or might recur spasmodically in case of earthquakes shaking the district; and that the levels of the Suez Canal and the Sweetwater Canal may yet be disturbed by it.

In conclusion of this part of the subject, a word may be said of the names of the Red Sea. In the Bible, the sea crossed by the Israelites is the "Yam

Suph," or sea of weeds. This name I would attribute to the abundance of the beautiful green waterweed (*Ceratophyllum demersum*), which now grows very plentifully at the mouth of the Sweetwater Canal, and was probably much more abundant when a branch of the Nile ran into the narrow extension of the Red Sea now forming the Bitter Lakes. The name Red Sea is of later origin, and seems to have been derived from the colour of the rocks bordering its upper part. The Eocene and cretaceous limestones assume by weathering a rich reddish-brown hue; and under the evening sun the eastern range glows with a ruddy radiance, which in the morning is equally seen on the western cliffs, while these colours contrast with the clear greenish-blue of the sea itself. Such an appearance would naturally suggest to early voyagers the name "Red Sea."

The recent revelations of the Egyptian records give us the right to affirm in this connection that a remarkable preparatory provision was made in the providence of God for the deliverance of His people by political and military events altogether beyond their control. The campaigns of Rameses II. in Western Asia, extended as they were all the way to the banks of the Orontes, must have greatly weakened the Hittites and other nations of Canaan, while at the same time they created depletion and discontent in Egypt itself. The few years of the reign of Menephtah were harassed with the invasions of

the Delta; and though these were repelled, this must have been with much loss to the Egyptians, and the eastern fortresses which held the Israelites in subjection must have been depleted of their garrisons. Further, the death of Menephtah led to an unsettled period, and apparently to usurpation leading to those very short reigns, the last of which, that of Siptah, may have been cut short by the catastrophe at the Red Sea. In any case, it seems now certain that the anarchy which led to the rise of the twentieth dynasty was directly or indirectly a consequence of the Hebrew Exodus. All these circumstances must have conspired with the increasing severity of the oppression to facilitate the mission of Moses and Aaron.

In tracing the farther progress of the Israelites from Egypt to Sinai, I shall avail myself almost exclusively of the work of the Ordnance Survey, which leaves nothing to be desired so far as topography is concerned.

The party employed in this important work consisted of Captains C. W. Wilson and H. S. Palmer, R.E., under whose joint direction the survey was conducted, four non-commissioned officers of the Engineers, the late Mr. E. H. Palmer, of St. John's College, Cambridge, as Linguist and Philologist, Mr. C. W. Wyatt as Naturalist, and the late Rev. F. W. Holland, who devoted special attention to the geology of the country. The objects of the expedition are stated in the introduction to the Report

to have been to "bring the material appliances of the Ordnance Survey to bear on the questions at issue, by subjecting the rugged heights of the peninsula to the unreasoning though logical tests of the theodolite and land-chain, of altitude and azimuth compasses, of the photographic camera, and the unerring evidence of the pole-star and the sun." It was not hoped to obtain any actual monuments of the march of the Israelites, but to determine the sites referred to, and ascertain the correspondence or differences of the localities with the historical narrative, and to fix the limits of the native tribes mentioned. With reference to all these subjects there seems to have been entire agreement of the members of the party on essential points, and such complete coincidence of the actual features of the country with the requirements of the Mosaic narrative as to prove it to be a contemporary record ot the events to which it relates, unless, indeed, we can believe one of the later narrators, supposed by some recent critics, to have had access to a survey as complete as that now in our possession.

Modern geographical exploration has gone over the ground traversed by ancient expeditions, or famous from wars and sieges, with various results as to the historical credibility of the narrators of these events. Bible history has often and in many places been subjected to this test, and has certainly been remarkably vindicated by the spade and the measuring-line. But perhaps no instance of this is more

remarkable than that afforded by the magnificent report of the Ordnance Survey of Sinai, both because of the positive and clear character of its results, and of the antiquity and obscurity of the events to which it relates.

Some three thousand years ago, according to a history professedly written by contemporaries, the Hebrew people, migrating from Egypt, sojourned in this inhospitable region for forty years on their way to Palestine. No one in the intervening ages is known to have followed their precise route. Arab and Christian traditions have, it is true, ventured to fix the sites of some of the leading events of the march. Travellers have passed hastily over portions of the ground, and have given to the world the impressions produced on their minds by crude observation without accurate measurements. The results arrived at were so various and discordant that any one of half a dozen theories might be held as to the actual route and its more important stations, and sceptics might be pardoned for supposing that the writer of the history knew less of the ground than many of the subsequent visitors. But now science intervenes with its special methods. A *corps* of trained surveyors, armed with all the appliances of their art, and prepared to make observations as to climate, geology, and natural history, enter the peninsula at the point where Moses is represented to have entered it, and prepare to follow in his footsteps. They first endeavour to settle approximately the

crossing-place of the fugitives,[1] and inform us of the precise circumstances which must have attended that event, not omitting the strong east wind which still sometimes blows with terrific force down the gulf. they examine the Wells of Moses and test their water, and describe the structure of that remarkable *Shur*, or wall of rock, from which the locality derives its Bible name, and which barred the way of the Israelites towards the east and caused them to make a long *détour* to the south. They proceed southward from station to station and well to well, noting remarkable coincidences heretofore overlooked, with reference to the characteristics of the terrible wilderness of Sin, the various ways by which the table-land may be penetrated from the coast, the apparently devious course of the Israelites, and their "encampment by the sea." They show how the host must have turned abruptly to the east by Wady Feiran, and how this brought them into conflict with the Amalekites. They explain the tactics of the battle of Rephidim, with the effect of the victory in opening the way to a junction with Jethro and the Midianites, and to the great and well-watered plain of Er Rahah in front of Mount Sinai. They show how this plain and mountain fulfil all the conditions of the narrative of the giving of the Law, and explain the necessity

[1] They had not the advantage of beginning their journey at the west end of Wady Tumilat, or of knowing the precise positions of Pithom and Succoth. Hence they are content to place the crossing at the present head of the Red Sea.

for the miraculous supply of water before the fight with the Amalekites, and the supplies of water and pasture to which that battle gave access.

As we follow the laborious investigations of the surveying party, and note the number and complexity of the undesigned agreements between their observations and the narrative in Exodus and Numbers; as we study their account of the geology, productions, and antiquities of the country, trace its topography on their beautiful maps and photographs, and weigh their calculations as to the supplies of water, food, and pasturage at different stages of the journey, we feel that the venerable narrative of the Pentateuch must be the testimony of a veracious eye-witness, and all the learned theories as to a late authorship and different documents disappear like mist. The writer of Exodus and Numbers had no idea that after thirty centuries his veracity was to be subjected to the test of a scientific survey; but he has, nevertheless, so provided for this that even his obscurities, imperfect explanations, and omissions now tend to his vindication.

All this would be of extreme interest were the Exodus merely an old story, like the siege of Troy or the tragical history of Mycenæ. But it is much more than this, much more than even a national movement in assertion of the rights of the oppressed and of the sacredness of freedom. The Exodus was a new departure in the higher life of humanity. It was a great revival of Monotheistic religion at a

time when it seemed likely to perish. It restored the hopes of a coming Saviour. It initiated a religious literature which reached back to the Creation, and which culminated in the New Testament. The roots of all that is most valuable in religion to-day lie in the Exodus. Therefore, it is of the highest importance to know whether the history of this event, preserved to us in the Hebrew Scriptures, is accurate and trustworthy. If it is a myth or an historical novel, or even a well-meant compilation of traditions and documents by an editor living long after the event, we might feel that its authority in all respects was shaken. As it is, we may rejoice in the possession of at least one true and carefully written history, however we may regret that so many volumes of learned historical criticism have been reduced to waste paper. The authors of the report on the Sinai Survey make no pretensions to be either critics or expositors of the Bible, and they are prepared to state what they see, independently of the consequences to any one. Hence it is most instructive to observe how, as they unsparingly sweep away old traditions and the conjectures of travellers and historians, ancient and modern, the orignal record stands in all its integrity, like the great stones of some cromlech from which men have dug away the earth under which it has been buried.

To those who have placed reliance on such theories of the Pentateuch as those of Graf, Kalisch, Kuenen, or Welthausen, the disclosures of the Survey of

Sinai must come like a new revelation. Henceforth the only rational theory as to the composition of the historical parts of Exodus and Numbers, is that they are contemporary journals of the events to which they relate, and that they have not been subsequently revised or altered even to such an extent as to explain facts obscure to any one except a contemporary, or to remove seeming contradictions requiring knowledge of the ground for their solution. It is even startling to find that the apparent omissions, repetitions, and inconsistencies which have been ingeniously employed to sustain theories of a composite and late authorship become, when studied on the ground, the most convincing proofs of contemporary authorship and the absence of any subsequent revision. Had these writings been subjected to any considerable revision between the date of the Exodus and that of the Ordnance Survey, they could scarcely have failed to present less of a photographic truthfulness than that which at present characterizes them. This must at least be the theory which will commend itself to every intelligent student of the report of the Sinai Survey; and it is to be observed that the facts of this report are final in a scientific point of view, and cannot be invalidated by any critical process, so that, in so far as the central books of the Pentateuch are concerned, the occupation of the disintegrating and destructive critics is absolutely gone, or can be valued only by those bookworms and pedants who

are determined to shut their eyes against scientific evidence.

It is impossible even to summarize the facts of this elaborate survey without the reproduction of the maps, sections, and photographs which illustrate it. The following may however be selected as leading topics. (1) The correspondence of the recorded route of the Israelites with the topography and geology of the country ; (2) The site of the battle of Rephidim, and the meeting of Moses and Jethro ; (3) The Mountain of the Law, and the plain before it.

The members of the expedition select the vicinity of Suez as the place of the crossing of the Israelites in preference to the basin of the Bitter Lakes, as advocated above, and suggested by Mr. Poole and M. de Lesseps, and by the engineers of the Suez Canal, and in preference also to the wider part of the gulf farther down, as held traditionally by the Arabs, and supported by some of the older authorities. The practical difference will be, as compared with the view advocated above, that the three desert marches without water will, as already stated, intervene before the halt at the Wells of Moses, which our explorers take as the immediate starting-point after the passage of the sea.

The passage of the sea, with its terrific accompaniments of darkness, wind, and rain, almost paralleled according to the reports of the Survey by the wild north-easterly storms that sometimes, at the present day, rage at the head of the Gulf of Suez, must have

deeply impressed the timid multitude; and the re-action to the tumultuous joy of deliverance is grandly expressed in that song of Miriam, which is the first song of victory in the Bible, and whose refrain is:—

> "Sing ye to the Lord, for He hath triumphed gloriously.
> The horse and his rider hath He thrown into the sea."

But the weary march of three days through the wilderness that followed, must have sorely tried the patience and endurance of the people, coming as it did in the reaction after a great excitement; and even the abundant water of Ayun Mousa must have tasted bitter and brackish after the sweet water of the Nile.

When at length, foot-sore and consumed with thirst, they reached the springs of Moses, they may have drunk the water with avidity, but it soon palled on their taste, and the name Marah—"bitter," expresses the sense of its inferiority to that of the beneficent stream of Egypt. The water in these wells is abundant, but more or less bitter and saline, varying in quality in different wells and at different seasons, the mineral matter present being apparently largely the carbonate of soda. The Israelites naturally murmured, and Moses was instructed to work a miracle for their relief. It is curious to observe that this sweetening of the water by throwing into it the branches of a tree is, from a chemical point of view, one of the most remarkable miracles on record, since soda is one of the last possible bases to be precipitated

from water by any natural means. This miracle is, therefore, less explicable by natural causes than even the crossing of the Red Sea, or bringing water out of the rock. It is amusing to notice the expedients by which learned and well-meaning writers seek to explain the sweetening of the waters by natural agencies. One informs us that branches thrown into saline waters form nuclei for the deposition of the salts, apparently not knowing that this implies a saturated solution, and could never render it potable. Another gravely says that the Arabs at present know no means of sweetening the water. He might have added that the best chemist would be equally at fault. Neither the nature of the result nor the means employed are at present explicable. We only know that the effect was temporary, as the waters have returned to their original salinity, which is mitigated only by the removal of some saline matter by microscopic organisms, and by the dilution which takes place in the wet season, when the water is somewhat sweetened.[1]

[1] With reference to other miraculous elements in the narrative of the Exodus, no scientific explanation can be given of the water issuing from the smitten rock or of the manna. With regard to the latter, though a saccharine manna is produced by a tamarisk (*T. mannifera*) and by the camel's thorn, both found in the peninsula of Sinai, the property of putrefaction when kept, ascribed by Moses to the manna, shows, as Johnston long ago noticed, that it was not a merely saccharine matter like the vegetable mannas, but contained nitrogenous material, which would also account for its nutritive quality, so that we know of no natural source whence it

From the Wells of Moses the Israelites, if they intended to go to Sinai, had but one course open to them, and this accompanied with many difficulties. Before them, and nearly parallel with the coast, runs the precipitous wall of rocks which forms the edge of the great desert table-land in the centre of the peninsula, the Badiet et Tih, or Desert of the Wanderings. The escarpment of the Tih consists of nearly horizontal beds of limestone, of the Cretaceous and Eocene periods, or of the same geological age with the limestones of Palestine and Egypt, and which spreads over a great area in Arabia, resting on an older sandstone, equivalent to the Nubian sandstones of Egypt.

These are all marine formations, and they yield in most places a dry barren soil with many flints, of which there are great numbers in the limestone. From this rocky wall the district in which the Israelites had entered probably derives its Scriptural name of Wilderness of Shur, or of the wall. The great escarpment thus designated not only presented

could have been derived. On the other hand, the supply of quails would merely require an unusual determination of the ordinary migration of those animals. The same remark applies to other miracles in which natural agencies are mentioned. It is to be observed, however, that no biblical miracle is necessarily a contravention of natural law, but only a determination of natural causes in ways beyond our control or comprehension; and that, just as is the case in the early history of Christianity, miracles are more abundant in the initial and critical periods of the great movement of Israel.

an obstacle to the direct route to the eastward, but the desert above it was no doubt occupied by formidable bands of Amalekites. Hence we find the Israelites turning to the south, along the plain between the Shur and the sea.

"As the Israelites, leaving Ayun Musa, turned their faces southward, away from the land of their bondage and the scene of their great deliverance, they must have gazed on the same features which now strike the eye of the traveller on his way from Suez to Jebel Musa, for the general aspect of the desert can have altered little. On their left would be the long level range of Er Rahah, an unbroken wall except where the triple peak of Jebel Bisher breaks the monotony of the outline; in front, the terraced plain, several miles broad, sloping gently down to the bright blue sea, and beyond the sea to their right the picturesque line of cliffs, on one point of which the name of Ras Atakah (Mount of Deliverance) still lingers."

A little farther on are Wady Gharandal and Wady Useit, one of which must be the Elim of Scripture, with its wells and seventy palms—how pathetic and eye-witness-like the counting of these trees by people who had only recently left Goshen with its abundant palm groves! but these were probably the only ones in a long stretch of desert journey. From Wady Gharandal two roads lead toward Sinai, one inland, the other near the coast, the second being the easier; and the writer of the Book of Numbers, no doubt

aware of this double road, informs us that the way toward the shore was followed by the Israelites, and that after leaving Elim they encamped by the sea (Numbers xxxiii. 10).

This part of the journey, extending from the Wells of Moses about eighty miles to the southward, is through a desert country with no general verdure except a few herbs and shrubs, sufficient to afford browsing to Arab flocks, and supplies of water at only a few places, including the Wells of Moses—Wady Useit and Wady Gharandal being the only places where it is good and plentiful. The country so far is sufficiently open to afford no serious impediments to men and animals, or even to carts.

Beyond the encampment by the sea the Israelites entered on a new and hard stage of their journey—the "Wilderness of Sin," identified with the desert plain of El Marka, which is characterized by Captain Palmer as one of the most dismal spots in the whole peninsula. It is, he says, in great part, a "wretched, desolate expanse of flints and sand, nearly destitute of vegetation."

Here the Israelites approached one of the mining districts and smelting works of the old Egyptians. In the plain of El Marka and in neighbouring wadys are still to be seen extensive heaps of slag; and copper ores as well as turquoise mines were worked in the sandstone east of the plain, as well as in the gneissic ridges beyond. It appears from the inscriptions discovered that these mines had been worked

long before the Exodus, and that they were probably abandoned at the time of the passage of the Israelites; or if not, the slaves employed in them would fraternize with the mixed multitude which followed the camp. The name "Sin," applied to this wilderness, is derived by some Hebrew scholars from a root signifying "to be sharp," and from which it is conjectured that Sinai itself may come; and that this may mean the sharp or peaked mountain. As to the plain, it may have been called Sin from its thorny bushes; or, as these are common everywhere, perhaps, more likely, from its peculiar abundance of sharp flints, making it painful to the feet.

In this wilderness of Sin the Israelites, as was but too natural, seem to have reached an uncontrollable stage of discontent and murmuring, saying, "Would to God we had died in the land of Egypt." The following extract will show something of the reason of this, as appreciated by the officers of the Survey in passing over this plain.

"To journey over these low, scorching plains in the full glare of an Arabian sun, is something more than trying, even in the winter months. . . . From about nine to eleven in the morning of a bright day, when the sun's power is not yet tempered by a cooling sea breeze, travel is almost intolerable. Heat is everywhere present, seen as well as felt. The waters of the gulf, beautiful in colour, are mirror-like, almost motionless, only breaking upon the beach in a sluggish, quiet ripple. The sky, also beauti-

fully blue, is clear and hot and without a cloud; the soil of the desert is arid, baked, and glowing. The camel-men, usually talkative and noisily quarrelsome, grow pensive and silent, the camels grunt and sigh, yet toil along under their burdens in a resolute, plodding way. The Europeans of the party, half roasted, half suffocated, become languid and feverish, and wish themselves anywhere out of the exhausting heat and glare. Even the Bedouins, usually indifferent to the sun's rays, now draw their *thaubs*, or white linen tunics, over their heads and shoulders, and tramp along under the lee of their camels, glad to avail themselves of the niggard scraps of shadow."

It is interesting to observe that the murmurings of the Israelites in this wilderness are not for water, which exists in springs along the inner margin of the plain, but for food; and it was here that the quails and the manna were first given to them.

From the wilderness of Sin the Israelites, in order to reach the Sinaitic Mountains, must have turned eastward, inland, by the valley now known as Wady Feiran; and they may either have entered directly the mouth of this valley, or crossed over by the Egyptian mining settlement of Magharah. The former is thought the most probable route, unless a portion of the less encumbered of the host may have separated and crossed over by the latter. To have gone farther south would have involved them in a still more formidable desert, with less prac-

ticable means of access to the objective point of their march.

Along the Wady Feiran, the host marched until it was arrested for a time by the Amalekite resistance at Rephidim.

The battle of Rephidim evidently arose from a mustering of the Amalekite and other Arab tribes to oppose the entrance of the Israelites into the heart of the peninsula, where their own towns and pasture lands were situated. The scouts of these people must have watched from the eastern ridges the progress of the Hebrews southward, uncertain perhaps of their ultimate intentions; but when they turned inland along the Wady Feiran, the main and most accessible route to the interior, their object must have been at once understood; and an immediate muster would take place of all the available force of the Amalekites to bar their further progress, while it appears that parties were also sent to cut off stragglers in the rear, or to make flank attacks from the lateral wadys, so as to impede their advance,—a mode of warfare suited to the character of the country, and referred to in Deut. xxv. 18:—"How he met thee by the way and slew the hindmost of thee, all the feeble behind thee, when thou wast faint and weary." This passage is thus perfectly connected with the account of the battle in Exodus.

The ground for the decisive contest was well chosen by the desert tribes, long accustomed to defend their country against the Egyptian armies; and

it may be well to describe the scene of the battle somewhat in detail.

The lower part of the Wady Feiran is dry and desert; but its upper part, above the entrance of the lateral valley of Wady Aleyat, is comparatively well watered and verdant, and was no doubt very valuable to the native tribes. At the commencement of this fertile portion there is a strong position flanked by hills, and affording good means of retreat in case of defeat. The defenders of such a position would also have the advantage of water and pasturage, while their assailants must march for three days through an arid waste. On the one hand, the Amalekites were here defending the frontier of the habitable country, under favourable circumstances; on the other, the Israelites, after the dreary march through the wilderness of Sin and the lower stretches of Feiran, would hope, when they reached the upper part of the valley, to enjoy comparative ease and plenty. How bitter, then, would be their disappointment, when, arriving faint and thirsty, they found the pass occupied by their enemies, ready to bar their entrance, and so situated that defeat or retreat would be equally fatal to the assailants. There was no way of flanking the position of the enemy. They must conquer, or return to perish in the thirsty desert through which they had been marching. Accordingly, the biblical narrative informs us that, on reaching this place, where they had no doubt expected to find rest and water, the

Israelites "chode with Moses," and gave way to the utmost alarm and irritation. It was here that the rock was smitten to give water to the people; and surely there never was greater need of a miraculous intervention. Refreshed and strengthened, a chosen band under Joshua attacked the position of the Amalekites, and after a protracted fight, extending throughout the day, and apparently after several repulses, succeeded in storming the position and putting them to flight. Moses watched the fight from a neighbouring hill, and prayed to God for the success of Israel; and when the battle was decided, he raised an altar to Jehovah, calling it Jehovah Nissi (The Lord my banner), and he is said to have written a memorial of it in "the book"—that book of records which we now have in Exodus and Numbers. The explorers identify a hill, Jebel et Tahûneh as the "Gibeah" on which Moses must have stood to witness the fight; and not far below the field of battle is one of those rocks which the Arab traditions indicate as the smitten rock from which the water flowed.

It is worthy of note that before reaching Rephidim the Israelites would have passed over the outcrop of the cretaceous limestone, and of the underlying sandstone, now known to be of carboniferous age, and would have entered on the much older gneiss and slate underlying the sandy and gravelly bed of the wady, and flanked on either hand by the high granitic or syenitic masses of Serbàl and Banàt,

the whole constituting a wild and alpine scenery altogether strange to the greater part of the people, and fitted to impress them with awe and terror. On the other hand, the walking is now good, and generally over a clean granitic gravel, the deeper colours of the old rocks are less glaring in the sunlight, and there are many high cliffs, giving the "shadow of a great rock in a weary land." The scenery of this first of the battles of the Lord's host is so vividly sketched by Palmer that it would be wrong not to quote a part of his description.

"The road now lies wholly among the older rocks, whose sombre lines and varied outlines afford a pleasant change and relief to the eye after the glare and sameness of chalk, and the somewhat over-rich colouring of the sandstone cliffs. The ranges, especially on the left, here take fanciful forms, and rise in long serrated ridges, now and then surmounted by graceful cones." (He then describes the banded appearance of the higher hills, caused by dark red, purple, and olive green dykes of dolorite and diorite traversing the dull brownish gneissic bedded rocks.) "From a point almost a mile farther on, the character of the route gradually changes, and the scenery increases in grandeur at every mile. We are now entering the intricate labyrinths of the Sinai mountains, approaching the huge clusters of which Mount Serbàl forms the crowning feature; the hills draw closely in on either hand, the wady becomes more and more winding

the higher you advance, and its bed ere long contracts to but half or even less of its former width. High banks of alluvial deposits, cut through by the passage of torrents, guard the mouths of tributary valleys; chalk *débris* disappears and gives place to boulders of gneiss and granite; shade is now abundant, the air cool and bracing, and the spirits of the scorched traveller, half depressed it may be by the fatigue and exposure of his march, now rise to buoyancy and even to enthusiasm." Here occurs Hery el Khattatin, according to Bedouin tradition the scene of the miracle of water in Rephidim, where is a large block of fallen granite covered with pebbles, placed there by the Bedouins in commemoration of the event. In this neighbourhood are also many of the Sinaitic inscriptions, which, however, the explorers do not believe to be of great antiquity. Above this place the scenery of the pass becomes so wild and grand as almost to overwhelm the mind; here and there stupendous cliffs rise perpendicularly above the path, elsewhere the slopes are covered with immense slides of disintegrated rocks; and the devastating effects of winter torrents are plainly seen in the main valley and its tributary glens. The rocks, from the hill tops to the valley's level, are to all appearance absolutely bare. At the mouth of Wady Umfùs the traveller halts to enjoy a glance of Jebel el Banàt, a towering ridge of red granite, of matchless depth of colour, and the yet more magnificent view of Jebel Serbàl, now near

at hand. A mile farther on we came to the little oasis of El Hesweh—palms, water, and Bedouin dwellings—a bright spot of living green in the midst of stern desolation, and just where a wide rugged valley, Wady Aleyat, descending from the eastern slopes of Serbàl, comes in from the south-east, we get our first view of the great palm-grove of Wady Feiran, a rich mass of dark green foliage winding through the hills."

It was in front of this Eden of the Sinai desert that the Amalekites are supposed to have posted themselves; and we may imagine the discouragement of the people when they found the sword of the desert ranger excluding them from this paradise and threatening to drive them back into the wilderness, and the earnestness of Moses in his prayer that success might be granted to the arms of Joshua.

The battle of Rephidim opened to the Israelites a comparatively fertile and watered country leading to the great plain before Sinai. Further, it enabled them to open communication with the Midianites dwelling on the east side of the peninsula, on the gulf of Akabah, and who were friendly to Moses and his people. Accordingly, we find that immediately after the battle, Jethro, the priest-chief, was able to meet Moses, and to bring to him his wife and sons, who for safety had remained in Midian; and advice and guidance were obtained from the friendly Midianites.

The whole route traversed, with the localities of water, may be reviewed as follows :—

Place of Crossing to		
Ain Mousa . .	30 miles,	brackish water.
to Ain Hawarah .	78 „	saline water.
„ Wady Gharandal.	85 „	water.
„ Wady Useit. .	91 „	water.
„ Wady Shebakah .	106 „	some water by the way.
„ Sufsafeh, the "Mount of the Law" . . .	188 „	abundant water near Sufsafeh.

The actual position of Mount Sinai has been a subject of keen controversy, which may be reduced to two questions: 1st, Was Mount Sinai in the peninsula of that name or elsewhere? 2nd, Which of the mountains of the peninsula was the Mount of the Law?

As to the first of these questions, the claims of the peninsula are supported by an overwhelming mass of tradition and of authority, ancient and modern; and though Dr. Beke has adduced very plausible reasons in favour of a position east of the Gulf of Akabah, our explorers show conclusive geographical evidence against this view. They think, however, that his suggestion that some portion of the forty years' wandering took place in the great Arabian desert, merits consideration, and that this extensive desert region deserves careful exploration in this connection.

If this question be considered as settled, then it remains to inquire which of the mountain summits of that group of hills in the southern end of the peninsula, which seem to be designated in the Bible by the general name of Horeb, should be regarded as the veritable "Mount of the Law." Five of the mountain summits of this region have laid claim to this distinction; and their relative merits the explorers test by seven criteria which must be fulfilled by the actual mountain. These are: (1) A mountain overlooking a plain in which the millions of Israel could be assembled. (2) Space for the people to "remove and stand afar off" when the voice of the Lord was heard, and yet to hear that voice. (3) A well-defined peak distinctly visible from the plain. (4) A mountain so precipitous that the people might be said to "stand under it" and to touch its base. (5) A mountain capable of being isolated by boundaries. (6) A mountain with springs and streams of water in its vicinity. (7) Pasturage to maintain the flocks of the people for a year.

By these criteria, the surveyors at once reject two of the mountains, Jebel el Ejmeh and Jebel Umm-alawi, as destitute of sufficient water and pasturage. Jebel Katharina, whose claims arise from a statement of Josephus that Sinai was the highest mountain of the district, which this peak actually is, with the exception of a neighbouring summit twenty-five feet higher, they reject because of the fact that it is not visible from any plain suitable for the encamp-

ment of the Israelites. Mount Serbàl has in modern times had some advocates; but the surveyors allege in opposition to these that they do not find, as has been stated, the Sinaitic inscriptions more plentiful there than elsewhere, that the traces of early Christian occupancy do not point to it any more than early tradition, and that it does not meet the topographical requirements in presenting a defined peak, convenient camping-ground, or a sufficient amount of pasturage.

There only remains the long-established and venerated Jebel Musa—the orthodox Sinai; and this, in a remarkable and conspicuous manner, fulfils the required conditions, and besides illustrates the narrative itself in unexpected ways. This mountain has, however, two dominant peaks, that of Jebel Musa proper, 7,363 feet in height, and that of Ras Sufsafeh, 6,937 feet high; and of these the explorers do not hesitate at once to prefer the latter. (See cut facing this chapter.) This peak or ridge is described as almost isolated, as descending precipitously to the great plain of the district, Er Rahah, which is capable of accommodating two millions of persons in full view of the peak, and has ample camping-ground for the whole host in its tributary valleys. Magnificent photographs of this plain and the mountain are given in the work, which leave no reason to doubt that it is just such a theatre of the giving of the Law as the most sanguine and vivid imagination would conceive. "From the time

when the traveller enters the plain, the peak of Sufsafeh stands out sharp and clear against the sky," and he never loses sight of it for a moment till "he crosses the dry wady bed at its foot and gazes up at the tremendous cliff in front of him, and which is sufficiently steep to be described as a mountain that may be touched." Further, it is so completely separated from the neighbouring mountains, that a short and quite intelligible description would define its limits, which could be easily marked out. Our illustration, reduced from one of the photographs of the Survey, is sufficient to show the character of the mass of granite, diorite, and gneiss constituting the mountain, and its strong contrast with the flat plain formed of recent deposits. This plain is itself at some elevation above the sea-level (nearly 5,000 feet), giving a comparatively temperate climate and mountain air, while the peak of Ras Sufsafeh rises abruptly from its upper part to an elevation of 6,830 feet.

Another remarkable feature is, that we have here the brook descending out of the mount referred to in the Exodus, and besides this five other perennial streams in addition to many good springs. The country is by no means desert, but supplies much pasturage; and when irrigated and attended to, forms good gardens, and is indeed one of the best and most fertile spots of the whole peninsula. The explorers show that the statements of some hasty travellers who have given a different view are quite

incorrect, and also that there is reason to believe that there was greater rainfall and more verdure in ancient times than at present in this part of the country. They further indicate the Wady Shreick, in which is the stream descending from the mount, as the probable place of the making and destruction of the golden calf, and a hill known as Jebel Moneijeh, the mount of conference, as the probable site of the tabernacle. They think it not improbable that while Ras Sufsafeh was the Mount of the Law, the retirement of Moses during his sojourn on the mount may have been behind this peak, in the recesses of Jebel Musa, which thus might properly bear his name.

Other interesting considerations are of a political and military nature. It was necessary for the Israelites to have a secure dwelling-place for some time, in order that their religious and social institutions might be fully organized before their march northward to Canaan. For this purpose the plain of Er Rahah and the region in its vicinity were admirably fitted. It is in the very heart of the peninsula, and approached only by passes easily defended, one of which the Israelites themselves had to force at Rephidim. It was too remote to be attacked by Egyptian expeditions, had these been sent against it, and the Amalekites, after their chatisement at Rephidim, were not likely to assault a place whose strength was so well known. It was on the borders of the territories of the friendly

Midianites, with whom Moses had sojourned so long and was connected by marriage. It would thus give a secure abode, with supplies of water and pasture; and after the hardships already endured by the people, would appear to them a haven of comparative rest; while, on the other hand, it was sufficiently a wilderness to wean them from Egyptian habits and train them to the hardihood of a desert life.

In geological character the Sinai mountains, including the Mount of the Law, are of great antiquity and simple structure. They consist of a red syenitic granite associated with other ancient crystalline rocks, and on which rest mica schists and gneisses much older than the sandstone of the region, which is known to be of the age of our coal-formation rocks. Thus the syenite of Sinai, though a rock of igneous origin, must have been cooled down in the far back Palæozoic age of geology. This effectually and for ever disposes of the theory held by some interpreters of Exodus, that Sinai was a volcanic mountain, and that the terrific phenomena which accompanied the giving of the law were those of an eruption. It is to be observed also that "the thunders and lightnings and thick clouds" of the Mosaic narrative, rather resemble the appearances of an atmospheric disturbance than of a volcanic eruption.

Lastly, for the benefit of those who love to consider the purely human element in religion, Moses had sojourned in the region, and knew perfectly the

way by which he was leading his people; a way which he had fully learned in his long exile. The place had been indicated to him by Divine revelation; but, independently of this, it is evidently one of those grand shrines of nature which man vainly tries to rival in his temples and cathedrals, and which strike awe into the human heart, and lead it to lofty thoughts and imaginings; and such a place must have had peculiar impressiveness to a people reared in the flats of the Egyptian delta, and who had just been stirred by the marvellous experiences and excitements of their flight from Egypt. It was thus one of the most fitting spots on earth to be the theatre of the revelation to man of a new and purer faith, unmixed with the figments of human invention, and leading to a worship of the one God, the Creator.

The expedition did not discover any certain indications of the sojourn of the Israelites. The Sinaitic inscriptions, so called, are now known to be of less ancient date. There are, however, numerous Egyptian inscriptions indicating expeditions to work the mines of turquoise and copper, and dating as far back as the third or fourth dynasty, long before the time of the Exodus; and it is a curious coincidence that the latest king whose name has been recognised is that of Thothmes III., the last great king of the eighteenth dynasty, under which the Israelites flourished, and which was succeeded by that nineteenth dynasty, under the early kings of which their captivity commenced.

The numerous round stone houses attributed to the Israelites by Arab tradition, are supposed by the explorers to have been the abodes of the Amalekites. They are built with thick walls of rough stone, and the roofs are made with overlapping slabs, and are said to be exactly similar to the ancient "bothans" or beehive houses of Scotland; and they are also similar, in so far as the over-lapping stone arches and thick walls are concerned, to the peculiar houses of Peru and Central and Western America, as described by Squier and others. Some of them had been used as burial-places, and in these were found shell ornaments. There are also stone circles, like those in so many other countries, and which contain stone cists very similar to those found in ancient sepulchres in Europe. Those that were opened contained crumbling bones, with charcoal, shell beads, and flint weapons; and in one case, a bracelet of copper. All these are attributed to the Amalekites and other early races, and are to be carefully separated from the buildings and tombs of later dates, ruins of which abound in the peninsula.

That some of the more ancient sepulchral remains will yet be referred to the Israelites is not improbable; but it must be borne in mind that the region explored is only that of the three months' journey to Sinai, and of the encampment of about a year before the Mount. In this length of time little of a permanent character is likely to have been effected by the Hebrews; and if their dead were simply

buried in the soil, no surface trace may remain of the graves of those who died. All the indications in Exodus are also at variance with the idea that the Israelites at this time either erected permanent buildings or commemorated their sojourn by durable monuments. The whole of the arrangements of Moses were based on the idea of a temporary sojourn and a preparation for a march into Canaan; no mention is made of any inscription on stone except the tablets of the law; and the book in which Moses is said to have recorded the story of the fight at Rephidim (Exod. xvii. 14) was probably a roll of skin or papyrus.

The monuments of the children of Israel, if such exist in the peninsula of Sinai, are rather to be sought in those portions of it in which the longer sojourns of the forty years' wanderings occurred; and it is to be hoped that these may yet be subjected to scientific scrutiny similar to that already executed for the country between Suez and Sinai. As preliminary to this, a reconnoissance has been made by one of the party engaged in the Survey, Mr. E. H. Palmer; and the results have been given to the world in his interesting book—"The Desert of the Exodus."[1] He shows the hopeful character of the inquiry, by the suggestion that the numerous tombs at the Erweis el Ebeirig, the probable site of Kibroth Hattaaveh—the "graves of those who lusted," may be those of the people who died in the plague at

[1] London, 1871.

that place, after the second descent of quails. No excavations seem to have been made to test the truth of the suggestion, nor have detailed surveys been made of the regions extending from Sinai to Kadesh, and thence to the eastern border of ancient Edom, a region in which the long sojourn of forty years seems to have been passed—a sojourn which, as Mr. Palmer well remarks, is rather to be regarded as the residence of a numerous pastoral people in the country, than as a constant movement from place to place in a compact body.[1]

In the meantime the facts already stated, and still more the study of the maps and photographs of the Survey, cannot fail to impress us with the reality of this old Hebrew history. We have here no mere myth, illustrated by the fancies of enthusiastic pilgrims; but the itinerary of a hard and eventful march, through a country presenting the most marked physical features; and this is now compared with the careful measurements and scientific observations of men who have traversed it, step by step, with as prosaic accuracy as if the object had been, not to follow the wanderings of an ancient people, but to work out a practicable line for a high-road or a railway. The result is unquestionably to show that the writer or writers of Exodus and Numbers[2]

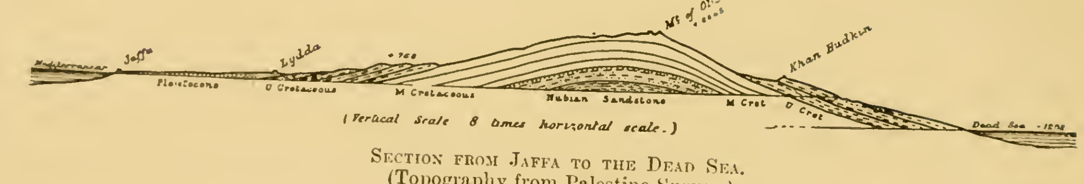
[1] For some interesting facts on this and allied subjects, see Dr. Trumbull's "Kadesh-Barnea."

[2] It seems not to occur to some critics of the Pentateuch (or Hexateuch as, with the Book of Joshua, it is now often

must have travelled through the region which is the scene of the history; must have personally experienced the difficulties of the journey, and must have been better acquainted with the country than any other traveller whose works we possess, up to the date of the Ordnance Survey.

The Exodus of the Israelites is not a mere question of curious antiquarian research. In that journey they were representatives and examples for us and for all the ages of the world; and their national migration was not only a grand protest against tyranny and injustice, but an important step in the development of God's plans for the salvation of our race. It is well, then, that this stirring and beautiful history is not a romance or even a legendary tale, but a true record which will bear the application of the severest tests of modern science.

called), that if Deuteronomy is a work of Moses, and Exodus, Leviticus, and Numbers mainly the writing of successive scribes keeping records during the wanderings, this should be sufficient to account for differences of style.



Section from Jaffa to the Dead Sea.
(Topography from Palestine Survey.)



Section from Beyrout to Zahleh.
(Partly from Diener.)

(*a*) Lower cretaceous limestone. (*b*) Lignitic and Trigonia sandstone (Cenomanian). (*c*) Lebanon sandstone (Cenomanian). (*d*) Upper cretaceous limestone with flints (Senonian). (*e*) Nummulitic (Eocene). (*f*) Pleistocene and modern.

CHAPTER VIII.

PALESTINE, ITS STRUCTURE AND HISTORY.

PALESTINE, though pre-eminent among Bible lands, I have left to the last, because it may well be the summing up of these studies, and on surveying its varied natural features we shall have occasion to refer to most that has gone before, and shall end with the central point of Bible literature, Jerusalem, "the mother of us all," and the place of the Cross on which the world's salvation was achieved.

In Palestine, as in other countries, geological structure furnishes us with the best key to physical features and early history. A glance at the geological map of the eastern Mediterranean shows that the Syrian hills represent a longitudinal series of ridges crossing the great transverse Mediterranean depression referred to in Chapter II., and terminating it on the east. The visible material of these ridges is limestone, sandstone, and volcanic rocks, mostly belonging to the Cretaceous and Tertiary ages of geology, though there is good reason to assume a foundation of crystalline rocks below. We shall

best perhaps understand this, and its relation to history, by tracing, in the same manner as we have done in Egypt, the series of processes by which this remarkable country came to be what it is, even though by so doing some appearance of repetition may be involved.

In the mountains of Sinai and in two narrow belts extending northward from them, along the sides of the Gulf of Akaba, and along the east side of the Arabah valley, nearly as far as the south end of the Dead Sea, we have a mass of crystalline rocks belonging to the oldest formations known in the world. The older gneisses and granites of these hills are probably of the same date with the Laurentian of Canada and the similar rocks ot Scandinavia and the western highlands of Scotland; and around these mantle schists and slates of scarcely more modern age, equivalents perhaps of the Huronian of Canada, or the Pebidian of Wales. These rocks culminate in the high mountains of Sinai, where they rise to an elevation of 8,500 feet above the sea-level, and constitute the nucleus and substratum of Syria, though appearing at the surface only in limited areas. They are, as explained in a previous chapter, connected below the surface with the long range of similar rocks which runs along the mountain ridge on the east of the Nile, and into the highlands of Abyssinia; the depression of the Gulf of Suez being apparently ot great geological age, or at least much older than the valleys of the Jordan and the Nile.

These rocks are, in short, part of the old crystalline foundations which underlie all the formations of our continents. In Palestine, as in Egypt, so far as known, a great gap exists between these venerable rocks and those next in succession. The earliest picture that we can form of the palæo-geography of the country is in the Carboniferous age, the period of the great coal formation of Europe, when the older crystalline rocks of Arabia and Palestine formed islands, reefs, or shallows in the sea, around which were being deposited sand-banks and gravel-beds, and layers of limestone, holding a few fossil shells. These constitute the sandstone and limestone which border the southern base of the Sinai mountains, and form part of the table-lands of Edom and Moab.[1]

In the succeeding Mesozoic age the water became deeper, and beds holding Jurassic shells are found high up on Mount Hermon,[2] but most of the deposits of this age seem to have been swept away or buried. Still later, in the Cretaceous or Chalk period, we have again shallow-water sandstones, the Nubian sandstone of Eastern Palestine; and then the whole

[1] See Hull, "Report on Geology of Palestine."

[2] I have not visited these exceptional Hermon deposits; but the fossils obtained from them, and of which numerous specimens exist in the Museum of the College at Beyrout, testify to their Jurassic age. They appear to occupy a very limited area, and, according to Fraas, are faulted against the cretaceous rocks; but their underground extension must be much greater than what this small exposure indicates.

of this area sunk down into that wide ocean which, in the Cretaceous age, covered all Western Asia, Southern and Western Europe, and Northern Africa; the age in which the great chalk beds of England and France were formed, and the thick limestones of the Lebanon and Judean hills. There were, however, some partial elevations in this age, in which the coaly beds of the Lebanon were produced; but the greater part of the area was under water and continued to be so in the early Tertiary, or Eocene. In the Miocene, or Middle Tertiary, a great change occurred. The cretaceous beds began to be bent into folds and heaved up above the waters, and then the distinction was instituted between the long range of the Judean and Lebanon hills, and the table-lands and mountains of Edom, Moab, and Hermon, with the Jordan valley and its extensions between. The latter was one of the most remarkable features of this elevation. It consists of a north-and-south fracture of the earth's crust, extending all the way from the Gulf of Akaba into Cœle-Syria, a distance of more than 350 miles. Along this great fault the crust fell in or subsided on the west side, so that as the hills of Western Palestine were gradually elevated on the one side as well as the table-lands and hills of Moab and Bashan, and Anti-Lebanon on the other, a great hollow was left, constituting the plain of Cœle-Syria [1]

[2] The modern *El Bekáa* or *Belkáa*, meaning "the valley," that is, the "Valley of Lebanon," as it is called in the Book of Joshua.

on the north, the valley of the Jordan and of the Arabah, and that of the Gulf of Akaba farther south. The deepest part of this great depression is that of the basin of the Dead Sea, or more properly the "Salt Sea," which now lies 1,260 feet below the level of the Mediterranean, and rather more below the Gulf of Akaba (according to Hull, 1,290 feet). This great disturbance of level took place in the Middle Tertiary period, and from that time the general relief of Palestine has been similar to what it is at present, though with some great changes of level.

Thus, if we go back to the old Laurentian period, in which the foundations of the dry land were being laid, we find a succession of sea deposits, carboniferous and cretaceous, laid down upon these; and that in Cretaceous and Eocene times, Palestine was, with possibly the exception of a few points in the extreme south and north, a part of a vast oceanic area. But as Tertiary time went on, it was elevated along great lines of north-and-south ridging and fracture, till it assumed somewhat its present form.

The remaining deposits in the country are of later date than this great elevation and subsidence. In the Pleistocene or latest Tertiary age there was a lowering of the continents of the northern hemisphere, contemporaneous with the later part of the Glacial age in the north. In this Palestine participated, and, so far as we can judge from the deposits on its lower grounds, went down nearly 300 feet

below its present level. At this time Africa was an island, the Isthmus of Suez being submerged, all the low country along the Palestine coast was under water, the Gulf of Akaba extended far north into the Arabah valley, and the Dead Sea stretched a long way to the south and north of its present limits, being nearly 200 miles in length. All this is proved by the extension of the Dead Sea deposits along the Jordan valley, north of the Lake of Genneseret, and by the beds with recent shells that line the Mediterranean coast, and that of the Red Sea. The climate at this time must have been much more cool and equable than at present; and it is probable that many northern forms of animals and plants extended their range into Palestine, while permanent snow, and perhaps glaciers, rested on Lebanon and Hermon. (See map, p. 317.)

The next change that took place at the close ot the Pleistocene reversed all this, and introduced that Second Continental period referred to in a previous chapter, in which the land of Palestine extended far into the Mediterranean, so that Cyprus was a part of the mainland; and what had been the Bay of Lower Egypt, and is now the Delta, became a desert, with the Nile running eastward into a lake on the site of the present isthmus, while the gulfs of Suez and Akaba were greatly reduced in dimensions, and the Dead Sea shrunk to its present size, or perhaps became still smaller. This must have been a time of much heat and aridity in summer, with perhaps

colder winters than now. In this age the plains along the Mediterranean were the haunts of the mammoth, rhinoceros, and bison; and it was in this age, as we have already seen, that man made his way into the Lebanon, and probably also into Southern Palestine. This was also the period of the closest land connection of Africa with Asia, and the time when African animals and plants of the Nile valley could pass most freely into Syria. On the other hand, it separated finally the marine animals of the Mediterranean from those of the Red Sea and Indian Ocean, so that, as already mentioned in the chapter on Egypt, at the present day we find an almost entire difference of marine fauna on the two sides of the isthmus. It is not necessary, however, to suppose, as some have done, that the animals have changed into different species since they were thus separated. We know on other evidence, for instance from the identity of the marine shells of the raised beaches of the pleistocene with those in the present sea, that they have not. All that is needed is, that the animals of the Red Sea area, which may have extended through to the Mediterranean, ceased to find suitable conditions of existence there after this separation, and those of the Mediterranean in like manner disappeared out of the warm waters of the Red Sea. Some of these are finding an opportunity to try the experiment over again by means of the Suez Canal, but we may be sure that few will succeed. This Continental period was

interrupted by the historical Deluge, which probably submerged, but for a short time, the whole of Palestine, and from which it rose with the diminished area of its present coast-line. We have seen in the last chapter how the same series of events affected Egypt. (See also map at p. 46.)

While these changes were going on, volcanic phenomena manifested themselves in Palestine, especially along the eastern side of the great Jordan valley fault, and produced the extensive basaltic formation and volcanic hills around Damascus and in the country of Bashan, the modern Hauran and Jaulan, and smaller patches in the hills of Moab. (See map, p. 455.) That these volcanic outbursts took place in the later Tertiary age, we learn from their products resting on all the other formations of the country. These volcanoes have, however, been extinct in the historical period, so that we are limited to the Pliocene and Pleistocene for their time of activity. Since, however, the basalts have been shown to be of different dates, these eruptions may have continued over a long time, especially to the southward, and it is even possible may have extended to the human period, and that antediluvian man saw the volcanoes of Bashan and Moab in action.[1] Hot springs are the present residual indications that the fires below are not yet quite extinct. We should notice here the important fact that in

[1] Recent observations of Notling would indicate that some of the lava streams of Moab may be of early modern date.

the course of these elevations and depressions, from the Miocene to the modern, the cretaceous and eocene limestones were being acted on by the waves, forming cliffs and terraces and inland sea beaches, and that they have also been eroded into ravines and valleys by the rivers and smaller streams. The latter action may have been much more powerful, both at those times when the climate was more moist, and at those in which it was more extreme and the land more elevated than in the present day. Much of the erosion of Palestine no doubt occurred in the Pliocene period, and when the levels of the country were very different from those at present. This consideration, as we shall find, answers some puzzling questions which have been raised as to the erosion of the valleys opening into the Jordan valley and Dead Sea.

The best method for a geological traveller with limited time, who wishes to acquaint himself with the structure of a country like Palestine, is to traverse it at right angles to the general course of its formations. My own plan, with this in view, was to make two cross sections along lines of special interest and easily traversed; and those which I selected were that from Jaffa to the Dead Sea on the south, and that from Beyrout across the Lebanon on the north. What I saw on these sections I shall endeavour to state, with the aid of the representations of them at the beginning of this chapter and the geological maps, and thus to place the present

condition of the country in connection with the sketch of its geological history already given.[1]

At Jaffa we have recent shelly sandstones and conglomerates with the species now found in the Mediterranean, and these are represented farther inland by gravels at such a height as to show that in the modern or Pleistocene period the coast has been depressed to that extent, or to the depth of at least two hundred and fifty feet below the sea. These beds are of the same age with those which underlie the delta and alluvial plain of Egypt, and extend upward with varying breadth at least as far as Beyrout.

Under and projecting through these, in the hill on which Jaffa stands, are somewhat older sandstones or clays. I was informed that a boring near Jaffa had passed through fifty-three metres of the sandstone, and entered clay said to contain a species of *Cardium* and other shells, which, however, I did not see. Hull has named this sandstone the "Philistian Sandstone." He had opportunities of studying it farther south, and thinks it may be as old as the Eocene. Its general relations would, however, I think, render probable a more recent date, possibly Miocene. These formations underlie all the plain of Sharon and Philistia, and extend thence into Lower Egypt, that is, if they are synchronous with the

[1] For further details the reader may consult Fraas, "Aus dem Orient"; Lartet, "Palestine"; Hull, "Report on Palestine"; Diener, "Lebanon."

Miocene and Isthmian beds which there occupy a similar position.

From the higher parts of Jaffa one may obtain a good idea of the physical characters of the maritime plain of Southern Palestine. Along the shore stretch banks and dunes of yellow sand, contrasting strongly with the deep blue of the sea, and shading off on the east into the verdure of the plain. Near Jaffa this is covered with orange orchards, laden in February with golden fruit of immense size, and which forms one of the most important exports of the place. To the south the plain spreads into the fertile flats of ancient Philistia, interspersed in the distance with patches of sand, the advanced guards of the great Arabian desert. To the north it constitutes the plain of Sharon, celebrated in Hebrew song, and extends for fifty miles to where Mount Carmel projects its high rocky front into the sea. On the inland side, the plain is bounded first by the rolling foot-hills of the Judean range, the Shephelah or low country of the Old Testament, and then by the hill country proper, which, clothed in blue and purple, forms a continuous range, limiting the view eastward from Jaffa.

The Tertiary beds form an undulating plain often of great fertility. It is twenty-five miles wide near the frontier of Egypt, twelve to fifteen opposite Jaffa, and runs off to a point at Carmel. Its southern part was the headquarters of the Philistines, whose frequent wars with the Israelites of

the inland hills occupy so large a portion of the Bible history. Along this plain was the great highway from Egypt to the north, traversed alternately by the armies of Egypt and Assyria, which naturally avoided the rugged and impracticable Judean hills. The maritime plain was also a granary for these invading armies, and it still produces much wheat and barley, though large portions of it are neglected and untilled, and the culture carried on is by means of implements as simple and primitive as they could have been in the days of Abraham. In February we found it gay with the beautiful crimson anemone (*A. coronaria*), which may have been the poetical "Rose of Sharon," while a little yellowish-white iris, of more modest appearance, growing along with it,[1] represented the "lily of the valley" of Solomon's Song.

As we approach on this section the Judean hills, and enter the foot-hills or Shephelah, we find limestones dipping to the west, and so presenting low ridges not more than about five hundred feet in height, with gentle slopes to the westward, and more abrupt escarpments to the east. These are Upper Cretaceous, with probably patches of Eocene here and there. Some beds are said to contain fossil fishes similar to those of the Upper Cretaceous of Lebanon. Many beds of this kind have been named cretaceo-nummulitic, and represented as holding both Cretaceous and Eocene fossils; but, so far as my observa-

[1] I suppose *Iris Caucasica.*

tion goes, I have reason to believe that though there is no abrupt break between the Cretaceous and Eocene in this region, there is no very gradual passage, and that the Eocene beds occur in patches left by denudation in hollows of the cretaceous beds, or perhaps let down into them by small faults. Further, the Eocene, as a whole, is much less developed in Palestine than in Egypt, while the Cretaceous attains to a greater thickness in the former.

Passing the Shephelah country, we next enter the rugged Judean hills, consisting of limestone of various degrees of hardness, with general westerly dips, and holding characteristic Middle Cretaceous fossils (*Nerinea*, *Ammonites*, *Ostrea*, *Radiolites*, etc.). These beds occupy the hills all the way to Jerusalem with moderate dips, or nearly flat; but cut by aqueous erosion into rugged terraced hills, in which the harder beds project, forming abrupt wall-like cliffs.

Our section here crosses the great interior ridge of Palestine, extending all the way from the plateau of the Tih, in Arabia, to the Lebanon mountains, where it culminates in ridges 10,000 feet in height,[1] with only a slight interruption in the Esdraelon plain, north of Carmel.

At Jerusalem we reach the summit of the broad anticlinal of the Judean hills, and the beds begin to dip to the eastward. Between Jerusalem and

[1] Jebel Mukhmel is said to be the highest Lebanon peak, and about 10,200 feet high.

Jericho the dips are to the eastward, though somewhat rolling and irregular, and the order is in the main ascending. Succeeding the limestones of Jerusalem we have others with flinty bands, often projecting from the weathered hill-sides, then red,

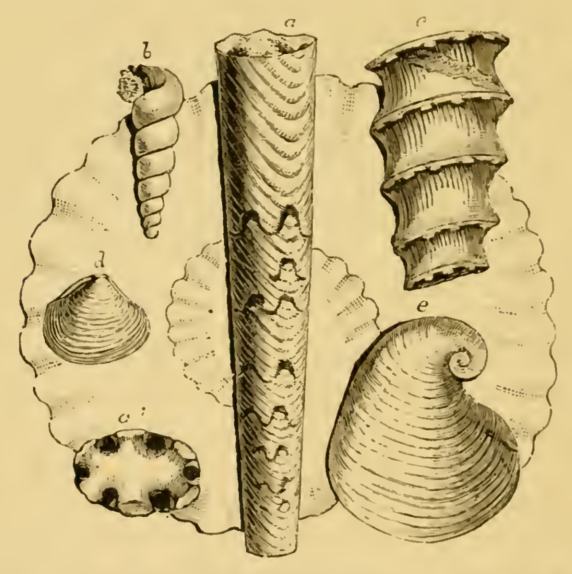


FIG. 30.—CRETACEOUS FOSSILS FROM JUDEA.—(*a*) *Baculites anceps*, Link; (a^1) Cross Section; (*b*) *Turritella Adullam*, Fraas; (*c*) *Nerinea Mammilla*, Fraas; (*d*) *Crassatella Rothii*, Fr.; (*e*) *Ostrea Mermeti*, Coq. outline of *Ammonites Mantelli*, Sowerby.

white, and green marls and limestones, with veins or patches of gypsum; then black and grey bituminous beds with scales of fishes, then soft chalky limestones with *Baculites* and other fossils, (Fig. 30), and finally harder limestones, which form the cliffs

in the Wady Kelt and on the shores of the Dead Sea. Tristram and Hull represent a dyke of felspathic rock as occurring near Khan el Ahmar, the reputed hotel of the Good Samaritan, on the Jericho road. This I did not see, but observed some altered ferruginous limestone, which may well have been in the vicinity of a dyke, and in which there were evidences of the exhalation of acid fumes in the presence of patches of impure gypsum. It has been stated that nummulitic limestones exist on the eastern side of the Judean hills, but I did not observe any of these fossils.

The Jordan valley, at the head of the Dead Sea, is occupied by the modern marls and other deposits of the lake when higher than at present, and these constitute steep banks on the sides of the river, and rise in places to heights of six hundred and seven hundred feet on the hills. They are often fantastically cut by the weather, owing to the unequal hardness of the beds of marl and imperfect limestones. (Fig. 32, p. 473.)

On the east of the Dead Sea rise cliffs of red, brown, and grey sandstone, the Lower Cretaceous Nubian sandstone, brought up here by the enormous fault previously mentioned, displacing the beds nearly 5,000 feet vertically; and on this, at a high level, rests the continuation of the Cretaceous limestones similar to those of the hills of Judea, and in a few places overflowed by basalts of Pliocene and Pleistocene age. (See Section, p. 474.)

All this may be seen more or less distinctly in the section facing the beginning of this chapter.

Let it be observed, before leaving this section, that all the features it exhibits extend lengthwise throughout the country from Arabia to Lebanon. The Judean hills are the southward extension of Lebanon, and flatten out into the elevated tableland of Northern Arabia. The valley of the Dead Sea extends all the way up the Jordan and down to the Gult of Akaba; and the Moab hills run north through Bashan to Hermon, and south through the mountains of Edom. Thus the section gives in a general way the structure of the whole land. We may, however, illustrate this by comparison with the section from Beyrout to Damascus. (See Section facing this chapter and maps.)

Beyrout, the ancient Berytus, is charmingly situated on the Mediterranean shore, on a projecting point forming the south side of the beautiful sweep of St. George's Bay, in full sight of the massive pile of Lebanon—in March, while we were there, white with snow, while all was semi-tropical summer in the gardens of the town. The site is a crag of upper cretaceous limestone, with flinty concretions,[1] separated from the base of the hills by a plain a few miles in width, and which, in the time of Pleistocene subsidence, must have been an island. It was selected by the Phenicians as a defensible maritime post, affording shelter for ships, and a practicable

[1] Upper Cretaceous, or Senonian.

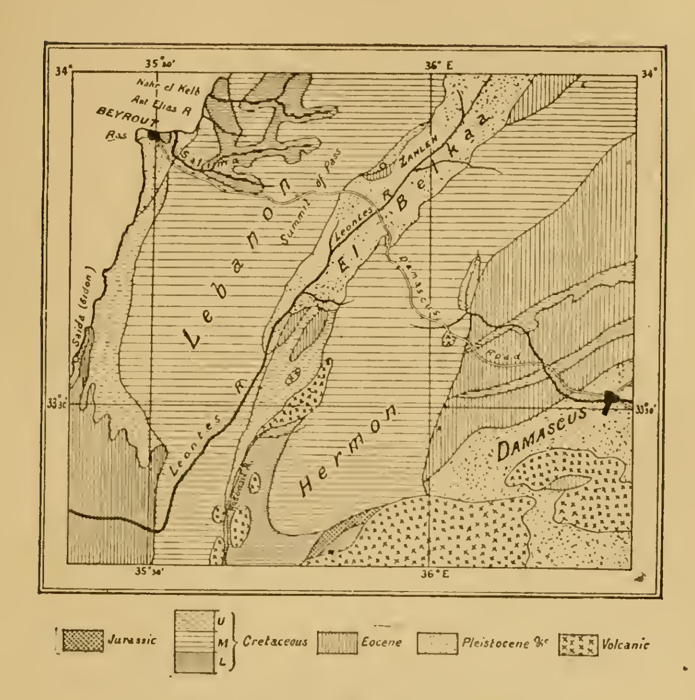


FIG. 31.—GEOLOGICAL MAP OF NORTHERN SYRIA.
(In part after Diener.)

This map shows the structure of the country between Beyrout and Damascus, with the relation of this structure to Lebanon, Hermon, the Bekáa, and the sources of the Leontes and Hasbani; also the position of the little Jurassic outcrop on Hermon, and part of the great volcanic district south of Damascus, as well as the disposition of the Eocene and the different members of the Cretaceous.

pass whereby to reach the great Cœle-Syrian plain and the fertile oasis of Damascus. The wisdom of their choice is vindicated by the persistent prosperity of the place. Everywhere, however, along this coast, we find the position of the principal Phenician cities admirably selected for purposes of commerce and defence. Beyrout is, at this moment, the principal seat, not only of trade, but of the educational work carried on in Syria; and the American college under the presidency of Dr. Bliss, and with an able staff of professors, is an institution of priceless value to the young men of the whole eastern coast of the Mediterranean.

The cretaceous rocks around Beyrout are carved by the waves into fantastic cliffs and grottoes, and are backed by recent beds of a brown calcareous sandstone quarried for building purposes, but holding remains of marine animals still common on the coast. It is a Pleistocene deposit, similar to the recent beds found at Jaffa. Here there is a still higher bed of red sand without fossils, and derived apparently from the waste of a band of sandy rocks in the Lebanon. It is in the main newer than the grey beds, but in one place is seen to be interstratified with these, so that it really belongs to the same formation. Above the red beds lies modern drift sand, blown inward by the wind; and in and under this are the flint knives and arrows of the primitive dwellers on this coast, referred to in a previous chapter. These beds are here at an elevation of

two hundred and fifty feet above the sea. They often show the diagonal bedding characteristic of such deposits. Inland on the Damascus road, at a place called the Bishop's Garden (Lokandel el Mitram), these beds are represented by conglomerate in two beds. The upper is red and has pebbles of dark red sandstone, with fragments of fossil plants. The lower, of a dark grey colour, has chiefly limestone pebbles and others of a trappean rock, which I did not see in place. These are evidently a littoral modification of the Pleistocene beds of the plain. At Ladekieh, off this line of section, Dr. Post has described shell-beds at a level of two hundred and fifty feet above the sea.[1]

Passing eastward, we enter on the base of the mountains, which consist of grey limestones similar to those of the coast, but probably a little older, and associated with a ferruginous dolomitic limestone.[2]

Succeeding these, we reach the lignitiferous zone, or Trigonia sandstone of the Lebanon, which, farther south, includes veritable beds of coal or lignite. Here this zone consists of red sandstones with grey and reddish marls and clays holding carbonized fragments of wood, apparently coniferous, and a few remains of cones. In some beds there are numbers of small oysters (*O. alicula*, Hamlin);[3] and near these

[1] *Nature*, vol. xxx.

[2] The upper part, or Hippurite limestone, is regarded as Turonian, the lower part with *Ceratites*, etc., as Cenomanian.

[3] Probably the same with *O. succini*, of Fraas.

beds is a limestone holding *Gryphea*. Other beds have shells of the genus *Trigonia*. The dip seems to the south-westward, so that the series is a descending one, exactly as on the western side of the Judean hills, where, however, the lignitiferous zone has not yet been recognised. It is to be noticed, however, that in the Lebanon, as seen in the section, this belt is not only thick, but bent over and faulted in such a manner as to occupy a wide space. This zone is not to be confounded with the Nubian sandstone of the south, being at a somewhat higher horizon in the Cretaceous system. The beds of soft red sandstone and marl are probably the source of the red sand of the coast. The grey sandstone of the coast is a result of slow accumulation of water-borne sand and shells. The red sand is the result of a more rapid deposit of red mud from the inland hills.

Eastward of this zone, in the valley of the river Salima, we find a lower and massive limestone, resembling that of the Judean hills. These beds are said to contain the celebrated "Dead Sea olives," the spines of a fossil sea urchin, *Cidaris glandarius*; but I had no opportunity of collecting these fossils. Ascending beyond the valley, the Trigonia zone is repeated, but with more limestone beds and a great variety of marine fossils, as if the old Cretaceous land had lain at the west, and the deeper sea where the highest mountains now are; and as these beds lie flat at the summit of the pass, we return to the

overlying Upper Cenomanian limestone. (See Section.) My aneroid made the summit of the pass 5,300 feet above the sea; but the surrounding hills rose to a height of more than 6,000 feet, and were composed of perfectly flat limestone, often forming mural cliffs. At the time of my visit, however, (March 7th to 10th) the snow lay deep on the upper parts of the mountain, and flurries of fresh snow were falling, so that the circumstances were not very favourable for studying the beds at the summit. Evidently, however, the mountain top is composed of flat beds of the upper limestone, just as in many places in Judea. Though less picturesque than peaks, these massive flat-topped hills, looking like gigantic ruined walls, have a very grand effect; and in winter, rising darkly out of the snow, or with the sun reddening their bald sides, they have a magnificence peculiarly their own.

So far, the Lebanon range is a great anticlinal like that of Judea, but on a grander scale; and from the summit the upper limestones dip generally to the eastward, and the rocks appear to be let down by north-and-south faults till they reach the level of the great Cœle-Syrian plain (El Bekâa), which, as seen from the summit of the Lebanon pass, looks like a vast flat, dotted here and there with groves of trees and bounded by the distant range of Anti-Libanus, presenting first, a series of rounded foot-hills, and beyond, the great snow-clad ridge of Hermon. This corresponds to the Moabite hills

farther to the south. It has, however, a new feature in the appearance in one part of Hermon of beds of Jurassic age. (See Map, p. 455.)

The plain here is the elevated continuation northward of the Jordan valley, but is in some parts 3,000 feet above the level of the sea. It is covered with modern deposits, including much superficial gravel, which shows that, high though this plain is, it has been submerged in the modern or Pleistocene period. At Zahleh, where we spent a pleasant evening as the guests of the late lamented Mr. Dale,—a noble example of a true Christian missionary,—and his amiable wife, we saw gravels resting on the flank of the limestone; and there are also at this place limited beds of Nummulitic limestone, of Eocene age,[1] so that we have here evidence that the Eocene, and probably the Miocene, sea covered this great and now elevated plain. The general section at the beginning of the chapter presents the succession above referred to, and may be compared with that from Jaffa to the Jordan.

We may now inquire as to the relation of the geological structure above described to antediluvian and post-diluvian man. We have already seen that the hunting tribes of the Second Continental period had found their way to the caves of Lebanon; and there

[1] Farther to the east and north, in the range of Anti-Lebanon, and north of Damascus, the Eocene beds attain to a great development, according to Diener, constituting the formation which he names the Desert Limestone.

is no reason why they may not also have colonized Palestine and North Africa, seeing that they were adventurous enough to extend their migrations to the West of Europe.[1] If their original home was in the Euphratean region, they would probably not tempt the dangers of the Syrian and Arabian deserts, but would make their way up the Euphrates, and thence westward to Damascus and the Lebanon, and down along the Syrian coast. They would find a belt of plain, probably well wooded, and with many edible fruits and numerous streams, and abounding in wild animals, including the hippopotamus, rhinoceros, and crocodile, along the coast, and the inland hills covered with dense forests, and abounding in smaller game, and also in excellent flints for implements. If they penetrated over the hills to the deep ghor of the Jordan and the Dead Sea, they would find an exuberant semi-tropical vegetation, including vast groves of date-palms, and a fauna akin to that of interior Africa. That a region so rich in the bounties of nature should have remained unoccupied in antediluvian times, when even the comparatively bleak coasts of Britain, France, and Spain were visited and settled, seems almost impossible. On the contrary, we may suppose that in the antediluvian centuries, Palestine may have been a well-peopled country. It

[1] Collequon has recently shown (*Matériaux pour l'histoire*, etc., for May), that Tunis was an early abode of palæocosmic man, who may have crossed to Africa by the Sicilian and Maltese isthmus referred to in Chapter II.

is to be observed, however, that the population would be most dense in the low grounds now under the the sea, and in the plains more or less covered with modern deposits; while, if there were cave men in the mountains, they would represent ruder tribes. Though flint implements are found on the surface in many parts of Palestine, I am not aware of the discovery of any undoubted remains of palæocosmic men farther south than the Syrian coast. There are in the hills of Palestine, as is well known, abundance of caverns and rock shelters; but nearly all of these have been in use, and their deposits disturbed in more modern times. Still, I have no doubt that digging in the Palestinian caves will yet disclose remains of the old hunters of the rhinoceros, similar to those which have been found in the Lebanon.

Another curious question is connected with this. It has been suggested by Lenormant and others, that those ancient and apparently pre-Canaanite populations, the Anakim, etc., referred to by Moses, but without any intimation of their descent, may have been remnants of the antediluvians. This idea belongs to hypotheses which have been long agitated, to the effect—First, that certain races, as the Turanians and the Negroes, may not belong to the race of Adam, but may be pre-Adamite peoples; [1] and secondly, that the Deluge may not have effected an universal destruction of man; but that beyond the ken of the survivors of the Deluge, who have

[1] Winchell, "Pre-Adamites."

recorded their experiences, there may have been isolated hill tribes which escaped the catastrophe, and afterwards came into contact with the neocosmic men in their migrations. In proof of this it is stated that certain races, for example the African negroes, have no traditions of the Deluge. In the case of these negroes, however, their linguistic and physical characters so blend into those of the Nubians and Egyptians, that their identity of origin seems indisputable.[1] As to the prehistoric men of Palestine, the question at present is insoluble. These populations may have been merely the descendants of early and obscure tribes, moving in advance of the more important migrations of men, and whose settlements had not been recorded in any written history. If any undoubted remains—say interments or caves of residence of these people—could be discovered, it might be possible to refer them either to the antediluvian or post-diluvian races, and so to settle this long-disputed question. It is much to be desired that a thorough exploration should be made of the floors of Palestinian caves. Old deposits in these may in many cases have been left undisturbed by their later occupants.

After the Deluge, the Bible history leaves no doubt that men almost at once made their way westward to Palestine and beyond its limits, guided perhaps by the tradition of the value of these lands in antediluvian times. Independently of the Ant Elias

[1] Latham.

people, already referred to, who may, however, have been, as already hinted, merely unrecorded early adventurers moving in front of the general migration, the earliest inhabitants were the Canaanites, including the Phenicians and Hittites;[1] and these populations seem to have been closely connected with, and in some sense subject to, the original centres of humanity on the east of the Syrian desert. This is a fair inference from the remarkable military expedition recorded in Genesis xiv., and in which kings from the Euphratean valley sought to re-conquer former but rebellious vassals in Palestine.

A careful study of the life of Abraham, as recorded in Genesis, shows, what we also learn from the Egyptian monuments, that before his time the Canaanites and Philistines had established themselves throughout the country, had built cities, and had become segregated into distinct communities, which seem, however, to have been merely small tribes, each centering itself around a fortified town, and sometimes forming confederacies for defence. The social and political condition of these communities was in fact very similar to that of the village Indians of North America, like the Iroquois and Hurons. This was indeed to some extent their condition up to the time of Joshua, and after the great communities of Egypt and Assyria, as well as the Hittite empire in the North, had aggregated themselves into nations. The physical features of

[1] See Note at end of chapter.

Palestine lent themselves to this state of things. The maritime plain, the rocky hills, and the rich and warm Jordan valley, and the wild hill country east of this, presented features so dissimilar, and even climates so different, that the pursuits and habits of their peoples were necessarily unlike; and the difficulties of movement of large bodies of men, and the facilities for defence, gave opportunity to isolation. On the other hand, the position of Palestine relatively to the Asiatic and African countries nearest to it made it a meeting-place of various races of people, nomadic and agricultural, and having little affinity with one another. This disintegrating influence of the nature of the country and its relations to other regions, made itself strongly felt, even in the time of the Hebrew monarchy. On the other hand, the plains of Egypt and of Mesopotamia, and the great plain of Cœle-Syria, afforded facilities for the aggregation of men into powerful nations.

When, therefore, we consider the low level and maritime character of the plains of Esdraelon, Sharon, and Philistia, the rugged terraced rocky hills of Judea and Samaria, rising to heights of more than three thousand feet, the rich warm plain of the Jordan, and the breezy pastoral heights of Bashan, we need not wonder that the people of the different parts of the country differed very much in their industries, and in their requirements for clothing and shelter, or that Palestine is, more perhaps than any other district of equal size, a region rich in

varied species of animals and plants; possessing, in fact, a fauna and flora which epitomize those of Europe, Asia, and Africa. Such characteristics have undoubtedly fitted it for producing a literature and a race the most cosmopolitan in the world.

A curious illustration of this is furnished by the classification of the cities of Judah in the Book of Joshua, as defined by the work of the Palestine Survey.[1] One group is on the frontiers of Edom, in the Nijeb, or South country, bordering on the Arabian desert, and a country of pasturage and Arab ways. A second group is in "the valley," possibly the Shephelah or foot-hills of the Judean range, composed of Eocene and upper Cretaceous beds dipping west, and so having their steepest side to the east, and distinct from the Philistine plains on the one hand and the Judean hills on the other. A third group occupies the Sharon and Philistian plain, rich in its broad wheat fields. A fourth includes cities of "the mountains," the terraced limestone hills of Judea, the home of the vine, the olive, and the fig. A fifth is in the "wilderness," that of Judea proper, extending along the east side of the Dead Sea, and in some places rich in grassy hill pastures; in others, degenerating into the "crags of the wild goats" and the partridges.

What a wealth of various habitat, resource, privilege, and difficulty is here, in this one district, the home of the greatest of the southern Hebrew tribes;

[1] Trelawny Saunders. "Trans. Victoria Inst.," 1882.

and that of Ephraim, the companion tribe in the north, rivals it in variety—perhaps, in some respects exceeds it. The following remarks, taken in substance from a little book by the writer, relate to the country between Jaffa and Jerusalem,[1] and illustrate these points.

The Judean hills, rugged though they are, have not been produced by any violent fractures of the earth's crust. The beds of cretaceous limestone, of which they are composed, constitute a great flat arch or anticlinal, sloping gently to the Mediterranean on the west, and to the Jordan valley on the east, and the hills have been cut by the sea and the torrents out of the nearly horizontal limestone beds, as a cameo is cut out of the layers of an agate or of a shell. Thus they present the appearance of successive terraces, meandering along the sides of the valleys, and rising one above another into rounded eminences. The aspect thus given to the hill-sides is of most peculiar character, and suggests the idea that this natural terracing must have given to the early inhabitants of the country the hint of that system of culture in terraces which prevailed in ancient times, when these now bare and desolate hills were clad with vines and olives. In some places, as near Kolonieh on this road, and at Bethlehem, where this culture still exists in perfection, one can realize the appearance which the country must have presented in the old Hebrew times, and, in

[1] "Egypt and Syria," Religious Tract Society.

connection with the value of the produce of the olive tree and vine, the large population it may have supported.

The description of the hills on this road given by Dr. Fraas is so graphic that it deserves quotation:[1] "Chalk marls, hard white limestone, and beds of dolomite alternate with each other, and form great steps on the mountain sides, such as I have nowhere else seen in equal beauty. The edges of the beds, three to ten feet thick, stand out like artificial walls, enclosing the hills. Olive trees and shrubbery overhang these natural ramparts, while the softer layers form slopes covered with green herbage, which is still richer in the moist hollows." It will be observed that this rugged Judean country presents a much more attractive appearance to the German geologist than to the ordinary traveller, to whom the hills seem mere irregular masses of stone.

It is also to be observed, that though on these hills there may be little soil, and that of a stony quality, this soil is of the most fertile character, and especially adapted for fruit trees and vines. The manner in which the German colony at Jerusalem is improving the apparently hopeless stony country between that place and Bethlehem, and rendering it productive, is a remarkable indication of this. It seems to have been customary in ancient times to store part of the produce of these hills on the ground, as there are everywhere in the ledges and

[1] "*Aus dem Orient.*"

cliffs small caverns excavated or enlarged by art, and which, while too small to have been occupied for residence, may have served as places of storage, or possibly, in troublous times, of concealment of the crops. A curious example of this practice occurs in the case of the ten men mentioned by Jeremiah, who said they had wheat, barley, oil, and honey "hid in the field," and were spared by the tyrant Ishmael on account of these treasures.

We ascend these hills through narrow valleys, on the sides of which, here and there, are beds filled with characteristic Cretaceous fossils.[1] The villages and ruins of old towns are perched on heights, and often at points suited to command the road through the valleys, indicating the fact that defence was and is of more importance than convenience, and reminding us of the wars and raids that have raged along the borders of the hill country of Judea from the times of the old Philistines till the present day. Even now, under that happy union of oppressiveness and imbecility which characterizes the Turkish Government, the heavily-taxed villager or farmer is obliged to be his own guard and policeman. Every person that one meets on the road is armed with a rifle, musket, pair of pistols or scimetar, or with some

[1] More especially there are white limestones with *Radiolites* and large *Ostreæ* and other bivalves. Other beds are filled with shells of the genus *Nerinæa*. These beds seem to correspond with the so-called Radiolarian zone of Fraas in the Lebanon, and are well seen half-way between Ramleh and Jerusalem

combination of these; or, failing any of them, with the round-headed club which, since the days of David, seems to have been the shepherd's weapon in this country.[1] One is at first a little alarmed by the approach of these armed travellers; but we soon find that they are by no means aggressive, and that their arms only express their own fears of attack.

The hills of the Shephelah rise somewhat suddenly from the plain to heights of about 400 or 500 feet, and then gradually ascend, ridge after ridge, to the summit of the Mount of Olives, 2,693 feet above the level of the sea; but this is by no means the maximum height of this great flat-backed ridge, which forms the backbone of Western Palestine.[2] To the south of our line of section it attains near Hebron a height of 3,300 feet; and northward it rises to a still greater elevation in the mountains of Samaria, before it gives off the oblique spur of Mount Carmel to the north-west. Beyond this it sinks into the plain of Esdraelon, to rise again in the hills of Galilee, and farther north to culminate in the great ridge of Mount Lebanon, which ascends to a height of 10,000 feet. Throughout all this extent the hills consist of Cretaceous limestone, ridged up in the centre, and cut by valleys and ravines at the sides, so that it may be compared to the backbone of an animal, with its ribs spread out

[1] The Shaivet, "rod" or "sceptre" of our version—literally a club. See Psalm xxiii., where the word is translated "rod."

[2] Measurements by the Palestine Exploration Survey.

at either side. The later Eocene limestones, which are so grandly developed in Egypt, are represented in Palestine only by small patches; and from a comparison of these formations in the Nile valley, in the Red Sea, in Judea, and the Lebanon, I am of opinion that there was an original difference, thicker deposits having taken place in the Cretaceous period in Syria than in Egypt, and precisely the reverse in the Eocene age.[1] Much of the physical difference between the two countries depends on this circumstance.

It is interesting to observe that this hill country, with the valleys descending from it, and the great Jordan valley to the east, was specially the land of the Israelites in their settlement in Palestine. The empire of David and Solomon was, of course, much more extensive, but it included peoples of other races. The Philistines seem always to have retained their hold of the maritime plain as far north as Jaffa, and the Phenician territory included the greater part of the seaboard north of Carmel, while the Esdraelon plain was a thoroughfare of nations. On the east of the Jordan the possessions of the Hebrews were somewhat precarious, and were limited by Moab and Ammon on the south, and Syria on the north. It is also to be observed that the chief seats of the dominant tribes of Judah and Ephraim were on this great ridge of Western Palestine. Another feature of the occupation of Palestine

[1] See notes in the *Geological Magazine*, 1884.

by the Hebrews, indicated by modern facts as well as by the statements in the Book of Joshua, is, that while the Israelites were the landed proprietors and the leading people of the cities, many of the original Canaanites remained as serfs and labouring people, especially in the more secluded districts. The fellaheen of the southern districts still resemble Egyptians, and may be descendants of the old Philistines, who, according to Moses, came out of Lower Egypt.[1] Those of Judea have the features of the Canaanites, as represented on Egyptian monuments, and are probably, in part at least, of the old pre-historic stock.

I shall devote the remainder of this chapter to two subjects of special interest,—the questions relating to the Dead Sea, and those which arise out of the site and surroundings of Jerusalem.

Lartet has called his last great work on Palestine "La Mer Morte," the Dead Sea, as if on that strange sheet of water the structure of the whole country hung. In a certain sense this is the case, since, as we have already seen, the great valley of depression in which this mysterious sea lies, is one of the most remarkable features not only of Palestine but of the world. This will appear more distinctly when we notice that a traveller from Jaffa to Jerusalem ascends from the sea to the summit of the Mount of Olives, 2,665 feet in a space of twenty-five miles, and descending from Jerusalem to the Dead Sea, in a

[1] Gen. x. 14.

distance of fifteen miles he finds himself 1,250 feet below the level of the Mediterranean, or has, so to speak, plunged into a deep pit 4,000 feet below the summits of the Judean hills; besides which the sea is in its deepest parts more than 1,200 feet deep, so that its bottom is nearly 2,500 feet below the surface of the Mediterranean. Fronting him on the east of the depression is the abrupt and rugged face of the mountains of Moab, rising to 3,000 feet above the sea. To these marvellous differences of level, the physical causes of which we have already con-

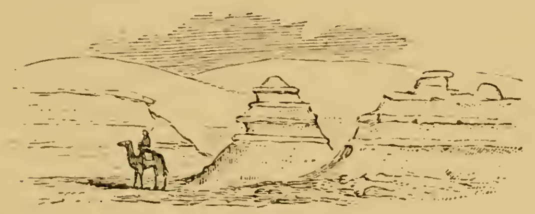


Fig. 32.—Ancient Dead Sea Deposits, eroded by the action of the weather.

sidered, we have to add the hot springs, the salt, sulphur, and bitumen deposits, and the extraordinary erosion and terracing of the country on the sides of this great depression.

To a few of these points it may be well here to devote some attention, as the most varied opinions have been held respecting them.

The hills on the west side of the Dead Sea consist of the Cretaceous limestones, including some beds extremely rich in bituminous matter, which lie low in the series at this point. The hills on the east

consist at their base of the Nubian sandstone, on which rest the Cretaceous limestones, and in places beds of basalt. In the valley itself, are a series of terraces of marl, limestone, and gravel, with gypsum and rock salt, recent deposits of the lake itself, and which mark its former great extent by rising to a height of 1,400 feet above its present surface. The diagram in Fig. 33 shows the general relations of these beds.

As to the saltness of the sea, this arises from its

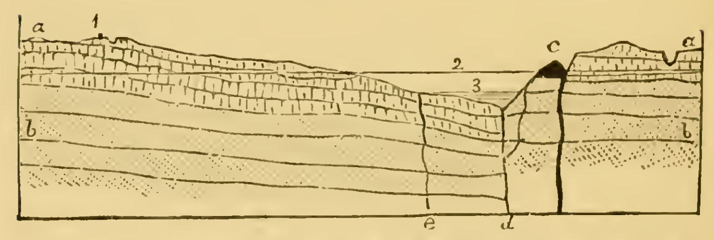


Fig. 33.—Section from Jerusalem to Moab, across the Dead Sea (after Lartet).—(1) Jerusalem, (2) Level of Mediterranean, (3) Level, of Dead Sea. (*a*) Cretaceous Limestones, (*b*) Sandstone, (*c*) Volcanic rock, (*d*) Line of Great Fault, (*e*) Fissures giving origin to saline springs.

want of an outlet, and the consequent necessity of parting with its water by evaporation alone. Hence all the saline matter washed by rains out of the Jordan valley, accumulates in this depression, and beyond what is dissolved in the water, has been deposited in beds of gypsum and rock salt, of which the beds now raised above the level of the sea at Jebel Usdum, are the best examples.[1] The density

[1] Lartet regards these beds as Cretaceous; but Hull, and I think justly, considers them modern.

of the water of the Dead Sea, is thus that of a saturated solution of soluble saline substances, and amounts to about one and a quarter times that of ordinary water (1·255 to 1·162); hence its remarkable power of floating up the body of a swimmer. As to the nature of the saline matter, this is rather that of the mother-liquor of a salt-work than that of the sea.[1] The water of the Jordan contains most of the substances found in the Dead Sea water, and the others are probably due to the springs and smaller streams which enter its sides, and many of which are strongly mineral.

The sulphur which is found in concretions in the marls of the Dead Sea deposits is not a direct product of volcanic action, as some have supposed. Sulphur, in the form of sulphuretted hydrogen, is evolved from many of the springs which enter the Dead Sea, and is produced either by the decay of organic matter in the presence of water and sulphates in the underlying rocks, or is a residual product of the old volcanic forces of the region, This gas, when it comes in contact with water, is oxidized, and a deposit of sulphur in a fine state of division results, which aggregates itself by molecular action into balls or concretions. I saw some of these in the marls at the north end of the sea; and better specimens were given to me by Dr. Paulus of Jeru-

[1] Chloride, bromide and sulphate of magnesium, sodium, calcium, and potassium, the proportions apparently varying much in different places and seasons.

salem. The association of native sulphur with gypsum, as in these marls, is by no means unusual.

As to the bitumen, I have no doubt that its source is in the bituminous limestones of the Cretaceous series. In marine limestones and shales of all geological ages, where any considerable quantity of vegetable or animal matter, either of terrestrial or aquatic origin, has been mixed with sediment, bituminization takes place, and thus are formed bituminous limestones and shales. These are undoubtedly the sources of bitumen and petroleum springs in all countries where they exist, and the bituminous matter may be forced from them either by heat, pressure, or the percolation of water. In this way, along the shores of the Dead Sea there are springs which produce petroleum ; and this, when hardened, becomes asphalt. Similar springs in the bottom of the sea produce the masses of asphalt which occasionally float up, especially after earthquakes ; as has been observed from the time of Strabo to the present day.

Another point which has given great trouble to geological theorists on this region has relation to the question of a possible former outlet to the Dead Sea, and of the cause of the terracing of its valley, and of the erosion of the neighbouring hills, in connection with the possibility of getting rid of all the *débris* produced by this erosion. Two possible means of outlet to the Dead Sea exist,—one to the south, by the Arabah valley into the Gulf of Akaba, one to

the north, by the valley of the Kishon, that "ancient river," as Deborah calls it, perhaps in allusion to some tradition of its former importance in this way.[1] As to the first of these: according to Hull, the summit of the Arabah valley, south of the Red Sea, is no less than 3,270 feet above the level of the bottom of the Dead Sea, or in round numbers, 2,000 feet above its surface. Unless, therefore, very great changes of level by transverse faulting or warping[2] of the beds have occurred, any outflow in this direction would seem impossible. On the north, on the other hand, the plain of Jezreel and the Kishon valley appear to be 375 feet lower, so that if the water in the Dead Sea were raised, without any relative change of level in the north and south ends, it might flow up the Jordan valley and run out into the Mediterranean to the north of Mount Carmel. Whether it ever did so we do not certainly know, but old Dead Sea deposits extend north beyond this line, and are said in places to reach to 1,400 feet above the level of the sea. According to Huddleston, an elevation of about 180 feet above this limit, or of 1,577 feet above the level of the Dead Sea, would enable the lake to effect an outlet in this direction, which it may very possibly have done in the time of Pleistocene depres-

[1] Huddleston, "Geology of Palestine,"—a very excellent and judicious memoir.

[2] Such warping in Pleistocene and modern times is now being established over great regions in America; and so is a cause deserving of consideration.

sion. It is through this depression that it has been proposed to flood the Jordan valley, or produce a "Jordan river canal."

The factors of time and changes of relative level enter however into these discussions. If the great fracture which lets down the Nubian sandstone and overlying beds to a depth estimated at 5,000 feet in the Dead Sea basin, began in Miocene times, it may not have been completed at first in its full effects. Thus, if we go back far enough, say to Miocene or Pliocene times, there is no difficulty in supposing a river to have run out into the Gulf of Akaba, and the further depression forming the Dead Sea basin to have occurred later, while the greatest extension of the lake did not take place till late in the Pleistocene. I should be inclined to attribute much of the erosion and ravine cutting of the hills of Moab and Judea to this Pliocene age, when we know that the more important operations of this kind were completed, before the glacial period in Europe and America. In the Pliocene continental period, the whole of Palestine was probably higher than at present, and the levels along the Jordan valley and Arabah may have been different from those now existing there, so as to permit an outflow. Besides, it is very probable that at the extreme crisis of the great Pleistocene submergence, Palestine was so far under water that the Judean hills may have been an island, and that the sea coursed freely along what is now the valley of the Jordan; and the same may

have occurred in the great post-glacial deluge, though this has certainly not cleaned out the lacustrine marls, which must be of older date. If, however, we admit that the greater part of the erosion of the hills may have taken place before the close of the Pliocene age, there will be no difficulty in disposing of the *débris* of denudation; always bearing in mind that the depression of the valley is not a phenomenon of erosion, but of subsidence, and that no small quantity of matter swept into the sunk area now exists in the lacustrine deposits themselves.

In descending from Jerusalem to Jericho, or from the water-shed of the Judean hills into the great depression of the Jordan valley and Salt Sea, we pass over the upper Cretaceous beds already referred to in this chapter, on the whole dipping to the eastward; and which are cut by the atmospheric agencies into bold hills and deep ravines, forming the rugged and abrupt western edge of the Jordan valley. Facing us on the east are the still bolder hills east of the Jordan, representing the long line of up-thrust beyond the great fault.

Of the beds observed, those that most concern our present subject are the black bituminous limestones, better seen at Neby Mousa, north of our line of road from Jerusalem to Jericho. These are chalky beds, originally marine sediments, composed largely of microscopic shells of Foraminifera, but now saturated with bitumen to such an extent as to have become perfectly black, and, in the case of some of

the richer beds, to burn like cannel coal.[1] These bituminous beds are in all probability the source of the asphalt and petroleum of the Dead Sea. The origin of the bituminous matter is no doubt,

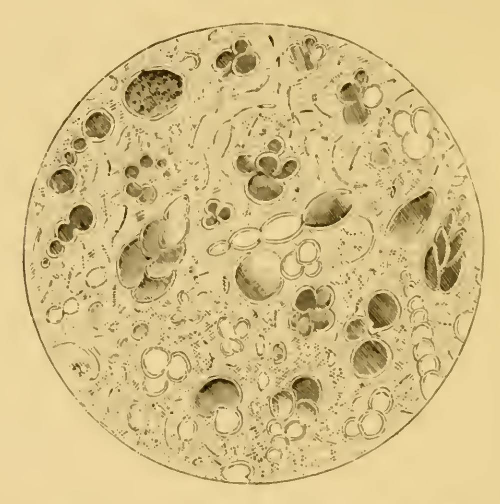


FIG. 31.—SECTION OF BITUMINOUS LIMESTONE of Neby Mousa, magnified, showing, *Globigerina*, *Textularia*, etc., with the cavities of some of them filled with bitumen, which also saturates the intervening matrix, composed of Coccoliths and fragments of Foraminifera.

like that of other bituminous limestones, from the decomposition of vegetable and animal matter in these beds.

Placing these facts in connection with what we

[1] This is the stone used for the black ornaments, etc., sold at Jerusalem as Dead Sea stone. When polished, it resembles a black marble, and is believed to be the black stone with which Solomon is said to have paved certain roads leading from Jerusalem.

have already seen of the geological history of this great depression, we are now prepared intelligently to discuss the questions relating to the Cities of the Plain and their tragical end, as recorded in the 19th and 20th chapters of Genesis.

From a geological point of view we are scarcely warranted in agreeing with a recent writer, in saying that the researches of my friend Professor Hull, or those of Lartet, and other previous observers have "disposed for ever" of the theory that the doomed cities or their sites, in whole or in part, have been submerged under the waters of the Salt Sea; and I feel confident that Professor Hull could not assert that they have necessarily had this effect, though his own opinion in the matter may favour that view. What they have effectually disposed of, is the theory that the Dead Sea originated at the time of the destruction of those cities, which is quite a different matter. There is indeed the best evidence that this salt lake has existed from early Tertiary times, and that in the ages preceding human history it was much more extensive than it now is. But this does not settle the question whether, at the time of the destruction of the cities, it may not have been a little larger or smaller than at present, or whether there may not have been some local subsidence in connection with the tragic event. The answer to these questions would depend on other considerations, distinct from the geological history of the sea.

As to the size of the lake, this would be regulated by the relative amounts of precipitation and evaporation in the Jordan valley and the basin of the sea at the time referred to. As to local subsidence, nothing could be more likely than this in connection with the disturbances recorded in Genesis. Such evidence as we have, however, gives no reason to believe that the climate of Palestine was less humid than at present in the time of Abraham. On the contrary, the probably greater amount of forest surface would justify the belief that it was at least less arid than in modern times. Further, if the country was better wooded, the floods of the Jordan would probably be less violent than they are now, and the level of the Dead Sea would be more constant. As to local subsidence, there are facts noted in a previous narrative in Genesis xiv., which give some reason to believe that this may have occurred. I take it for granted that, as Canon Tristram and Dr. Selah Merrill have so ably argued, the cities were at the north end of the sea, and that the vale of Siddim, in which their kings met the Eastern invaders, was also there. Now, these invaders are said to have marched up the western side of the sea, by way of Engedi, and to have been met by their opponents in a vale or plain full of bitumen pits. At present it would be difficult for an army encumbered with plunder to move along the coast of the Dead Sea northward of Engedi, and it does not appear that the host of Chedorlaomer and his

confederates went up the Engedi pass to the westward and round to the plain of Jordan through the hills of the Amorites. It is possible, therefore, that they may have passed along a fringe of low country now submerged, and in which were the petroleum wells. Tristram notes in this vicinity a band of bituminous rock in the cliffs and exudations of mineral pitch, but there seem to be no indications of the numerous petroleum pits referred to in Genesis, and possibly these may be now submerged. Nor would it be wonderful if the locality in question should now be occupied with deep water, since such local subsidence, occasioned by removal of material from below, might be of considerable vertical amount. It is proper to add, however, that the disappearance of the bitumen pits may be accounted for in another way, to be noticed in the sequel.

It may be urged as an argument against the occurrence of any subsidence, that the notice of the locality in Deuteronomy xxix. 23 would imply that in the time of Moses the site of the destroyed cities was believed to be a land characterized by salt and sulphur and dryness, or in other words, a plain covered with deposits similar to those which occur in various places around the sea; yet there is no contradiction between this and the supposition that a portion of the original plain had been submerged. What remained of it might present the characters of aridity and barrenness referred to.

With reference to the causes of the destruction of the cities, these are so clearly stated in a perfectly unconscious and incidental manner in Genesis xix., that I think no geologist, on comparing the narrative with the structure of the district, can hesitate as to the nature of the phenomena which were presented to the observation of the narrator. Nor is there any reason to suppose that the history is compounded of two narratives giving different views as to the cause of the catastrophe. On the contrary, the story has all the internal evidence of being a record of the observations of intelligent eye-witnesses, who reported the appearances observed without concerning themselves as to their proximate causes or natural probability.

We learn from the narrative that the destruction was sudden and unexpected, that it was caused by "brimstone and fire," that these were rained down from the sky, that a dense column of smoke ascended to a great height, like the smoke of a furnace or lime-kiln, and that along with, or immediately after the fire, there was an emission of brine or saline mud, capable of encrusting bodies (as that of Lot's wife), so that they appeared as mounds (not pillars) of salt. The only point in the statements in regard to which there can be doubt, is the substance intended by the Hebrew word translated "brimstone." It may mean sulphur, of which there is abundance in some of the Dead Sea deposits; but there is reason to suspect that, as used here, it may rather

denote pitch, since it is derived from the same root with Gopher, the Hebrew name, apparently, of the cypress and other resinous woods. If, however, this were the intention of the writer, the question arises, Why did he use this word *Gaphrith* (גפרית), when the Hebrew possesses other words suitable to designate different forms of petroleum and asphalt? In this language *Zepheth* is the proper term for petroleum or rock oil in its liquid state, while *Chemar* denotes asphalt or mineral pitch, the more solid form of the mineral, and *Copher* is asphaltic or resinous varnish, used for covering and protecting wood and other materials. As examples of the use of these words in the Pentateuch, Noah is said to have used copher for the ark, the builders of Babel used chemar or asphalt as a cement, and the careful mother of Moses used both chemar and zepheth to make the cradle of her child water-tight. These distinctions are not kept up by the translators, but a comparison of passages shows that they were well understood by the original writer of the Pentateuch, who had not studied the chemistry of the Egyptian schools to no purpose.[1] Why then does he in this place use this quite undecided term gaphrith? The most likely reason would seem to be, that he did not

[1] I do not know if it is necessary to apologize for assuming that Genesis is a Book of Moses. It is at least quite evident that its editor was trained in the schools of Egypt, and was better qualified to describe natural phenomena than the greater number of his critics and commentators in later times.

wish to commit himself to any particular kind of inflammable mineral, but preferred a term which his readers would understand as including any kind of mineral pitch or oil, and possibly sulphur as well. It would have been well if later writers, who have undertaken to describe the fires of Gehenna in terms taken from the destruction of the Cities of the Plain, had been equally cautious. It is interesting to observe in connection with this, that in the notice of the pits in the vale of Siddim, the specific word chemar, asphalt, is used; and it is in this particular form that the bituminous exudations of the region of the Dead Sea usually appear.

It is scarcely necessary to say that the circumstances above referred to are not those of a volcanic eruption; and there is no mention of any earthquake, which, if it occurred, must in the judgment of the narrator have been altogether a subordinate feature. Nor is an earthquake necessarily implied in the expression "overthrown," used in Deuteronomy xxix. Still, as we shall see, more or less tremor of the ground very probably occurred, and might, though it is not mentioned in the original narrative, have impressed itself on traditions of the event, especially as the district is subject to earthquakes.

The description is that of a bitumen or petroleum eruption, similar to those which, on a small scale, have been so destructive in the oil regions of Canada and the United States of America. They arise from the existence of reservoirs of compressed inflam-

mable gas along with petroleum and water, existing at considerable depths below the surface. When these are penetrated, as by a well or bore-hole, the gas escapes with explosive force, carrying petroleum with it, and when both have been ignited, the petroleum rains down in burning showers, and floats in flames over the ejected water, while a dense smoke towers high into the air, and the inrushing draught may produce a vortex, carrying upward to a still greater height and distributing still more widely the burning material, which is almost inextinguishable, and most destructive to life and to buildings.

In the valley of the Euphrates, according to Layard, the Arabs can produce miniature eruptions of this kind, by breaking with stones the crust of hardened asphalt that has formed on the surface of the bitumen springs, and igniting the vapours and liquid petroleum.

Now the valley of the Dead Sea is an "oil district," and from the incidental mention of its slime pits, or literally asphalt pits, in Genesis xiv., was apparently more productive in mineral pitch in ancient times. It is interesting in connection with this to notice that Conder found layers of asphalt in the mound which marks the site of ancient Jericho, showing that the substance was used in primitive times for roofs and floors, or as a cement to protect brick structures from damp; and it is well known that petroleum exudes from the rocks both on the sides and in the bottom of the Dead Sea, and, being hardened by

evaporation and oxidation, forms the asphaltum referred to by so many travellers.

The source of the bituminous matter is, as already stated, in the great beds of bituminous limestone of Upper Cretaceous age which appear at Neby Mousa, on the Jericho road, and at many other places in the vicinity of the sea, and no doubt underlie its bed and the lower part of the Jordan plain. From these beds bituminous and gaseous matter must have been at all times exuding. Further, the Jordan valley and the Dead Sea basin are on the line of the great fault or fracture traversing these beds, and affording means of escape to their products, especially when the district is shaken by earthquakes. We have thus only to suppose that at the time in question reservoirs of condensed gas and petroleum existed under the plain of Siddim, and that these were suddenly discharged, either by their own accumulated pressure, or by an earthquake shock fracturing the overlying beds, when the phenomena described by the writer in Genesis would occur; and after the eruption the site would be covered with a saline and sulphurous deposit, while many of the sources of petroleum previously existing might be permanently dried up. In connection with this there might be subsidence of the ground over the now exhausted reservoirs, and this might give rise to the idea of the submergence of the cities. It is to be observed, however, that the parenthetic statement in Genesis xiv., "which is the Salt Sea," does not

certainly mean under the sea, and that it relates not to the cities themselves but to the plain where the battle recorded in the chapter was fought at a time previous to the eruption. It is also to be noted that this particular locality is precisely the one which, as previously stated, may on other grounds be supposed to have subsided, and that this subsidence having occurred subsequently may have rendered less intelligible the march of the invading army to later readers; so that the explanation, "which is the Salt Sea," may imply that, in the opinion of the writer, the plain which enabled the invaders to attack the Sodomites and their allies in the manner recorded, did not exist in his time.[1]

It seems difficult to imagine that anything except the real occurrence of such an event could have given origin to the narrative. No one unacquainted with the structure of the district, and the probability of bitumen eruptions in connection with this structure, would be likely to imagine the raining of burning pitch from the sky, with the attendant phenomena stated so simply and without any appearance of exaggeration, and with the evident

[1] Lyell notices a subsidence as having occurred within the present century in Trinidad, which gave origin to a small lake of mineral pitch; and the well-known pitch lake of that island is supposed to have originated in a similar subsidence. The later subsidence is said to have caused "great terror" among the inhabitants; and if the petroleum or its gaseous emanations had been ignited, serious consequences might have ensued.

intention to dwell on the spiritual and moral significance of the event, while giving just as much of the physical features as was essential to this purpose. It may be added here, that in Isaiah xxxiv. 9 and 10, there is a graphic description of a bitumen eruption, which may possibly be based on the history now under consideration, though used figuratively to illustrate the doom of Idumea.

In thus directing attention to the physical phenomena attendant on the destruction of the Cities of the Plain, I do not desire to detract from the providential character of the catastrophe, or from the lessons which it teaches, and which have pervaded the religion and literature of the world ever since it occurred. I merely wish to show that there is nothing in the narrative comparable with the wild myths and fanciful conjectures sometimes associated with it; and that its author has described in an intelligent manner, appearances which he must have seen, or which were described to him by competent witnesses. I wish also to indicate that the statements made are in accordance with the structure and possibilities of the district as now understood, after its scientific exploration. From a scientific point of view, it is a description, unique in ancient literature, of a natural phenomenon of much interest and of very rare occurrence.

Nor do I desire to be understood as asserting that Sodom and its companion cities were different from

others in the facilities for destruction afforded by their situation. They were no doubt so placed as to be specially subject to one particular kind of overthrow. But it may be safely said that there is no city in the world which is not equally, though perhaps by other agencies, within the reach of Divine power exercised through the energies of nature, should it be found to be destitute of "ten righteous men." So that the conclusion holds—"except ye repent, ye shall all likewise perish."

I may be permitted to add that, notwithstanding all that has been done in recent times, there is still much room for the application of natural science to the interpretation of the more ancient books of the Hebrew Scriptures, which are undoubtedly the productions of men of culture and of keen and accurate appreciation of nature, but which have come down to us through ages of comparative darkness in regard to physical phenomena—a darkness unhappily scarcely yet dispelled even from the higher walks of biblical interpretation.

If we treat Jerusalem as we have treated Rome, and as a geological observer may deal with any ancient city, we shall find an original site of very different character, but giving equal evidence of suitableness to the ends of its existence, though without the feature of being based on ancient volcanic ejectamenta. Jerusalem rests on the Cretaceous limestone of the Judean hills, and is near the summit of the anticlinal ridge, or slightly to-

ward its eastern side. It is no less than 2,590 feet above the level of the sea, and occupies two little spurs of rock jutting out to the southward from the great limestone plateau to the north and west. The western and larger spur may be named that of Zion, the smaller, or eastern, that of Moriah and Ophel, and the Tyropean valley forms a low part of the city intervening.

The rocks on which Jerusalem is based consist of limestones of various qualities, with a gentle east-

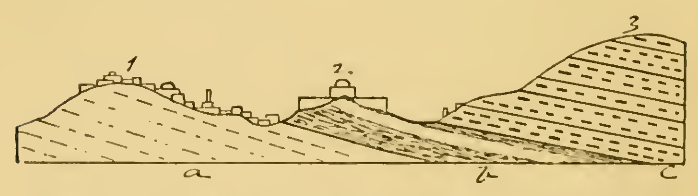


FIG. 35.—SECTION OF THE SITE OF JERUSALEM.—(1) Summit of Zion, (2) Summit of Moriah, (3) Mount of Olives. (*a*) Middle Cretaceous limestone, grey, red, white. (*b*) Softer white limestones, including the bed of *Melekeh*, or Royal Stone. (*c*) Upper Cretaceous limestone and marl, with flint.

erly slope, as represented in the section (Fig. 35). The lower beds belonging to the Middle Cretaceous[1] are mostly of hard variegated limestone, seen near the Jaffa gate and elsewhere on the western ridge. This is what is usually called the *Missie*, or hard stone, and is used for building and for paving stones. It is often prettily coloured, and when polished forms a variegated marble. Softer beds probably underlie the Tyropean valley, and on these rests the

[1] Cenomanian.

Melekeh,[1] or royal stone, the fine white compact limestone quarried in Jeremiah's grotto and in the great quarries under the eastern ridge. On this rests a repetition of the hard grey limestone, softer beds again probably occupying the Kidron valley; and in the Mount of Olives we have a thin-bedded or laminated limestone of Upper Cretaceous age, locally called *Kakule*, or cake stone, because thin-bedded and full of bands and concretions of flint.[2] The best of all these limestones for building purposes is the Melekeh; and this fact seems to have been recognised at a very early period, as the ridge of this rock has been entirely quarried through between the city wall and Jeremiah's grotto, and in the latter, which is seemingly an old quarry; and it has then been followed under the city itself in those great underground quarries which are called the Royal quarries, and which probably supplied all the stone used in the construction of the Temple.

One meets with the most contradictory statements respecting the identification of the parts of Jerusalem and its vicinity, as noticed in the Bible; and on some of these points the topography and geology throw much light. No one seems to doubt the identity of the Mount of Olives and the Kidron

[1] I find these names are differently given by some writers. I have taken them from specimens collected and prepared for me by Mr. C. Paulus, of Jerusalem, who, from his profession as a sculptor, knows them well.

[2] I suppose that the succession is regular, and without any considerable faults, of which I saw no evidence.

valley; and it is not possible to entertain any uncertainty about the site of the Temple, since its vast substructures remain, 1,500 feet in length by 1,000 in breadth, and, according to Warren's measurements, rising at the south-east angle to the great height of one hundred and fifty-six feet above the side of the Kidron valley. They constitute one of the noblest substructures ever erected for any building. These points being fixed, we have next to look for the locality of Mount Zion and the city of David, and the old city of the Jebusites, which resisted the Israelites and retained a quasi-independence till the time of David. Beginning with the first of these—it could not have been on the temple or Moriah hill, for in the time of David this was outside the city, and its summit was used as a threshing-floor for winnowing grain.[1] It must therefore have been upon the western or higher ridge, now usually named Mount Zion. This accords with the indications of the site, for this ridge is the highest and most defensible part of the whole position, and upon it now stands the citadel of Jerusalem. The old Jebusite city therefore must have occupied the ridge extending southward from the Tower of David, as it is called, along the higher western ridge, a position very like to that which Bethlehem occupies on a similar spur. This city of the Jebusites was undoubtedly, when captured, the original city of David. Millo, afterwards known as

[1] 1 Kings xxiv. 18.

Acra, was probably the northern continuation of this ridge, separated from it by a slight hollow, which lay on the northern side of the Jebusite fortress, and which now leads to the Jaffa gate. Millo was enclosed and fortified by David and Solomon, probably as far as the present north-west angle of the city wall, where are the remains of a very old tower of ancient Jewish masonry, known as the Tower of Goliath. The city was then long and narrow, stretching along one ridge only, but occupying a very strong position, assailable only at its northern end, except with great difficulty. At a later date, when David had purchased the threshing-floor of Araunah, on the eastern or Moriah hill, and when Solomon had built the Temple on it, connecting walls were thrown across the Tyropean valley at its northern and southern ends; and then the southern end of the temple ridge, known as Ophel, and leading down to the Royal Gardens in the Siloam valley, may have been occupied by Solomon, and may thus have become a second city or house of David. It seems to be an opinion very generally held, that the new palace, erected by Solomon and occupied by subsequent kings, was not in the original city of David, but on or near the Temple area on the south part of the Moriah hill. In like manner, in the later biblical books, Zion, the name of the higher and more conspicuous hill, was applied to the whole city, and more especially to that part of it consecrated to the Temple worship.

If we take this view of the topography, all the questions connected with the site of the Temple, the original extent of the city, and even the vexed question of the true position of the Holy Sepulchre, become comparatively plain. Perhaps the consideration of the two last-mentioned points may furnish us with the most useful illustrations, and may appropriately complete our survey of the topography of the Holy City in connection with its geological structure (Fig. 36).

The eastern of the two spurs of rock on which Jerusalem stands must thus, until the reign of David, have lain outside the city. This we may fairly infer from the narrative of the plague which was arrested at the threshing-floor of Araunah, the Jebusite, in connection with the erection of an altar by David on this threshing-floor, and his selection of the place as the site of the Temple to be erected by Solomon. The narrative of these events is found in the last chapter of the Second Book of Samuel, and in the 21st and 22nd chapters of the First Book of Chronicles. Let us look at the more important parts of these narratives. The prophet Gad, we are told, advised David to "go up and build an altar unto the Lord on the threshing-floor of Araunah the Jebusite." Araunah—called Ornan in Chronicles—was evidently a wealthy proprietor, having a threshing-floor on elevated ground near to the city; and he treats David with a princely liberality when he asks to purchase the ground. The narrative in

Chronicles then proceeds thus:—"At that time when David saw that the Lord had answered him in the threshing-floor of Ornan the Jebusite, then he sacrificed there. Then David said, This is the

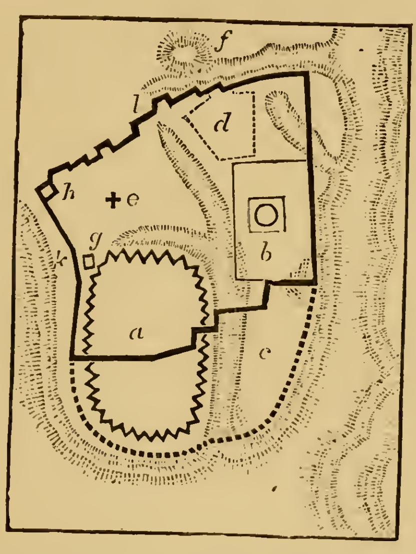


Fig. 36.—Sketch Plan of Jerusalem.—(a) Zion and old Jebusite city. (b) Temple area. (c) Ophel. (d) Subterranean quarries. (e) Church of the Holy Sepulchre. (f) Supposed Golgotha. (g) Tower of David. (h) Tower of Goliath. (k) Jaffa gate. (l) Damascus gate.

The present wall is indicated by a heavy black line, the old south wall by a dotted line, and the supposed position of the wall of the original Jebusite town by a zigzag line. The Tyropean valley is seen running up the middle of the city, and forking toward the Jaffa gate; and the Damascus gate is nearly opposite its north end. East of the city are the Kidron valley and the Mount of Olives.

house of Jahveh Elohim, and this is the altar of burnt offering for Israel. And David commanded to gather together the strangers which were in the

land of Israel; and he set masons to hew wrought stones to build the house of God." We are then told of other preparations, and that these were made for the Temple to be built by Solomon. Again, in 2 Chronicles iii. 1, we are told that Solomon built the Temple "in Moriah, in the place which David had appointed (or prepared) in the threshing-floor of Ornan the Jebusite." We learn from this that the threshing-floor of Araunah, in Mount Moriah, was the destined site of the Temple, and that the great quarries on the north end of and under the Temple ridge were already opened, and possibly some progress made in preparing foundations in the time of David, who must have selected the "melekeh" which forms the bed in which the quarries are excavated, as the most suitable stone for his purpose. The structure of the Moriah ridge and the excavations of Colonel Warren enable us to restore somewhat accurately the form of this ridge at the time when it was thus selected, and when its sides were probably clad with olive trees, and its top a bare breezy threshing-floor. It was a somewhat narrow rocky ridge, with a steep side toward the Kidron valley on the east, and a cliff or crag toward the Tyropean valley and the city. The ridge itself rose slightly toward the middle, and then descended rapidly towards the present pool of Siloam. It possessed on the east side a peculiar intermitting spring, the present Virgin's fountain, and the Pool of Bethesda of the Gospels, which

then discharged its waters into the Kidron valley, but in the time of the Jewish kings, probably by Hezekiah, was carried into the city under the Temple ridge, along the now celebrated Siloam tunnel, more than 1,200 feet in length.

The whole of the central part of this ridge is now occupied by the flat rectangular area of the Mosque of Omar, part of which is solid rock and part filled in or supported on the great series of arches known as Solomon's stables, and the whole surrounded by the vertical wall of megalithic masonry, which constituted the substructure of the Temple.

In the middle of this area, and under the centre of the dome of the mosque, projects a great irregular mass of rock, the Sakhra or sacred rock, of which many absurd tales are narrated by the Moslems, but which is a portion of the natural surface of the highest part of the ridge, which must have been left in its original state when Solomon's Temple was built, and presumably for some important purpose in connection with that Temple. It has in more recent times constituted the determining cause of the erection of the noble building which covers it, and which derives from it the name of "Kubbet es Sakhra," or "Dome of the Rock."[1] The rock is simply a portion of one of the harder grey beds of the natural summit of the hill, and consequently has been in its present place before the erection of any buildings,

[1] Its proper name. It is not really the Mosque of Omar, and it is even questionable if it is a Saracenic building.

so that it must have been for some reason left intact at the time of the original levelling of the ground for the Temple of Solomon—a fact which gives to it

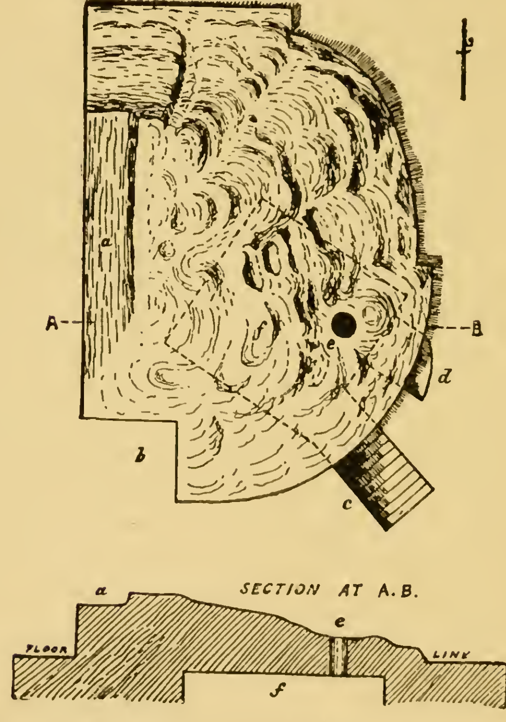


Fig. 37.—The Sacred Rock in the Mosque of Omar, Plan and Section. Reduced (from a model by Paulus of Jerusalem). (*a*) Step on west side. (*b*) Notch in south-west angle. (*c*) Entrance to cave. (*d*) Smaller opening to the same. (*e*) Round aperture in roof of cave. (*f*) Section of cave, but not showing the irregularities of the roof and sides.

great historical significance. It is approximately semicircular in outline, with the curved side, which

slopes downward, on the east, and the straight side, which is higher and cut off square, to the west. This corresponds with the general dip of the rock of the ridge. It is about 60 feet in its extreme length, and 50 in its greatest breadth, and rises in its highest part a little more than four feet above the surrounding pavement.[1] Under the south-east portion there is a roughly-hewn chamber of square form excavated in the rock. With this three openings communicate, namely a stairway leading down from the pavement, a small irregular opening near it, and a round hole on top. This cavern is high enough to enable one to stand upright, and its paved floor sounds hollow, as if there were an additional cavity below. The direction of the western side of the rock is north-north-west, or parallel to the longest sides of the Temple area. The surface of the rock has evidently been prepared at the west and east sides for building stonework on and against it. The west side is cut down perpendicularly, and has a square notch cut out of the south angle; and above the perpendicular face the upper surface is cut into a decided shelf, sufficiently wide to receive a stone wall. The lower eastern side is less modified, but the semicircular edge is cut even, and has two slight rectangular breaks in its continuous curve; and on the surface flat spaces and step-like notches are cut into the stone. The entrance to the cave beneath is evi-

[1] 4 feet 9½ inches.

dently modern, but the hole near it and the round opening in the top appear more ancient. On the whole, this sacred rock would seem to be an original portion of the natural surface of the ledge, slightly modified by art, and having under a portion of it an old granary or cistern, which was probably excavated before the Temple was built. It would appear that at the north end there is one of those circular hollows for offerings which are seen in rocks on the summits of many hills in Palestine, and this would indicate that it may have been an ancient place of sacrifice among the Jebusites long before the time of David.[1]

It would seem that the only rational explanation of this preservation of a portion of natural rock must be, that it was the spot occupied by that altar which David had consecrated, and which constituted the reason for the selection of this site for the Temple. Further, as the altar of burnt-offering in the Temple must be of unhewn stone, and on the natural surface of the ground, it was necessary to leave some parts of the surface untouched for this purpose; and what place so appropriate as the site of the altar on which David's great sacrifice was offered, and which he, apparently with the Divine sanction, through Gad the prophet, had consecrated as "the altar of burnt-offering for Israel"? Some have supposed that it was the Most Holy Place that stood on this spot; but

[1] W. Simpson, "Quarterly Statement, Palestine Exploration Fund," April, 1887. I did not observe this feature; but it is one which might easily escape notice, except in certain lights.

there would be no special fitness in this; and the position of the great altar here would accord very well with the traditional site of the building erected by Solomon, and with its form, which was evidently that of an Egyptian temple, with an outer and inner court and a lofty propylon or porch in front of the Temple proper, or Holy Place, with its inner sanctuary. The propylon must in this case have been a little west of the centre of the present dome, and the Holy and Most Holy Places west of this on the side next to the city—so that the Temple faced the east, and had its inmost shrine on the side toward the city. This would correspond very well with the Talmudic descriptions of the Temple and altar.[1]

If we are right in thus placing the altar of burnt-offering on the Sakhra, the Temple of Solomon must have stood nearly in the middle of the Haram area, on the same platform which now supports the Mosque of Omar. Its tower-like propylon must, like the present Dome of the Rock, have been the most conspicuous object in every view of the city. The courts in front of the Temple must have extended nearly to the west wall of the Temple area, while, as we learn from the Mishna, wider spaces lay to the south, north, and east, the whole of which were, however, probably surrounded with the long cloisters of Herod's Temple. We thus, I think, obtain, by starting from the sacred rock as representing the great central altar,

[1] As translated by Bishop Barclay and Dr. Chaplin.

a more definite idea of the Temple, and one more in accordance with the statements of ancient authorities than on any other view. We also obtain a most interesting identification of an old historic site, and can feel that we have here a spot which, if not the place of Abraham's sacrifice on Moriah, at least connects itself with the reign of David and the sacrifice on Araunah's threshing-floor.

The masonry of the retaining wall of the Temple area is a magnificent work of hewn stones, with marginal drafts, and beautifully fitted. This is at least the character of its older and lower portions. Every stone of the buildings that once crowned it has been thrown down, and their rubbish lies everywhere against its sides. The buildings now upon it are all of dates no older than the Christian era. Some of the entrances are probably as ancient at least as the Herodian time. The so-called double gate on the south side is one of the most interesting. It opens at the base of the great enclosing wall, and passes upward for 200 feet by two parallel arches, at the end of which were stairways leading to the surface of the area. In the porch at the entrance of these tunnels is a column strikingly Egyptian in appearance, and with a capital of palm leaves, or, as some interpret them, rows of acanthus. This double gate would present great facilities for the entrance and egress of processions or crowds of worshippers, and brings vividly before us that old time when the tens of thousands of Israel went up to worship here, singing

perhaps those beautiful "Songs of Degrees" which still form the best expressions of many types of religious emotion.[1] There has been much discussion as to the age of the great Temple area; but the recent explorations seem to have established the Solomonic age of the whole eastern wall; and, though there are some differences of structure on the south side, there seems no reason to doubt that the substructure actually prepared by Solomon included the whole, or nearly the whole, of the present Haram area, a work comparable in magnitude with the greatest of the Egyptian pyramids, and superior to them, when considered as the mere foundation of magnificent buildings which have wholly perished, and when taken in connection with the vast contrivances for water supply which exist beneath it, and which were connected originally with the high-level aqueduct conveying water from the springs in the Judean hills south of the great Pools of Solomon. These cisterns are said to be capable of containing ten millions of gallons of water. There is, however, no reason to doubt the statement of Josephus, that the great plan conceived by Solomon was completed by subsequent kings, and that large portions of the wall may have been repaired and rebuilt after the Captivity, or in the extensive restorations undertaken by Herod the Great. The Temple has disappeared, but its substructure remains intact, and the old sacred rock is still in its place, perhaps yet to wit-

[1] Psalms cxx. to cxxxiv.—Songs of ascent, or of going up.

ness other and greater developments in the history of the city of God.

The position of the Church of the Holy Sepulchre, as seen in the plan of the city, is so far within the walls, and on so central a part of the western ridge, that if in the time of Christ it was without the walls, the city must be very much limited in its northern extension. But we have reason to believe that the Jerusalem of the time of Pilate was much more populous than at present. Besides this, the old tower at the north-west angle of the city is undoubtedly a part of the ancient city wall, as is the Tower of David near the Jaffa gate, and Dr. Merrill has lately described an extension of the wall between these towers, uncovered in some recent excavations. Besides, there seem to be portions of old wall near the Damascus gate, and there is no defensible line for a city wall between this and the middle of the town. All these considerations militate against the claim of the present church to be on the site either of the crucifixion, or of the tomb of Jesus, while the points stated in the Gospels, though evidently not intended to fix the site as a holy place, are sufficient to indicate that the knoll (*f* in the plan of the city, p. 497) outside the Damascus gate, now used as a little Moslem cemetery, and at one time the public place of execution, is the real Golgotha, or "place of a skull," to which it also has a claim on account of its singular form, like that of a low-browed calvarium, with two sockets formed by old tombs excavated in

its front. This strikes every one when it is seen in certain lights. I have advocated the claims of this site in my little book "Egypt and Syria,"[1] for reasons which will be found in that work; but I shall here quote with some slight changes from a recent admirable summary of the facts in a paper by my friend Dr. Selah Merrill, and shall add some notes on the geology of this site of so great religious and historical interest.

"The theory that the present Holy Sepulchre marks the place of the crucifixion and burial of our Lord has never fully satisfied the minds of those who have given the subject their careful attention. This site, supposing it to be the true one, must have been without the walls of Jerusalem, in order to meet the requirements of the New Testament; and hence the city, at a time of great prosperity, must have been confined within such narrow limits as to have been almost insignificant in size. This is a kind of common sense argument which has great force. Furthermore, by drawing, as some scholars have done, the line of the second wall, which ran from the gate Gennath to the Castle of Antonia, and encircled the northern quarter of the town in such a way as to leave the Holy Sepulchre outside the city, Calvary is placed thereby in an exterior angle of the wall, and less than a stone's throw distant from it. It need hardly be said that the spot would, in that case, have been obscure and inconspicuous. On the other

[1] London, 1885.

hand, one gets the impression from the New Testament that the place of crucifixion was public and conspicuous, near a frequented road, and likewise that the place of burial was at some distance from the walls. It is difficult for the mind to rid itself of either of these impressions in reading the Gospels.

"For some years past there has been a growing conviction that the hill in which Jeremiah's grotto is shown, situated a little to the north-east of the Damascus gate, satisfied the conditions as to the site of Calvary better than any other spot in or around Jerusalem. Indeed, a large number of competent scholars have already accepted this hill as Golgotha. Hundreds of Christian tourists visit the place every year, and few of them go away unconvinced that both the arguments and the strong probability are in favour of this being regarded as the true site of the crucifixion. From the Mount of Olives and Scopus, from the road leading north past the Russian buildings west of the city, from many points north of the town, and from many of the housetops within Jerusalem itself, this hill attracts the eye by its prominence, and in favourable lights suggests that resemblance to a skull from which it probably obtained its name.

"The south face is vertical, and has in it the so-called 'Grotto of Jeremiah.' Farther along in this southern face, which does not run in a straight line, great quantities of stone have been quarried within the past few years. Towards the east the hill does

not fall in a single slope, but as it were in two terraces. The hill may be said to be prolonged in this direction, the eastern knoll or second terrace being a little lower than the other. The entire summit of the hill is covered with Moslem graves. This fact has no doubt prevented the hill from being bought up and built upon hitherto, and this alone still prevents the ground from passing into the hands of foreigners. This graveyard is an old one; and who can say that the hand of Providence is not specially visible in the preservation of this spot, in this strange manner, from the disgusting and degrading monkish traditions which would otherwise have sprung up about it? The level section of country north of the hill is pretty thickly covered with fine olive trees. To the east there is also flat land, or rather a broad valley, and beyond that a slight rise covered with olive trees, and one great pine tree, a landmark in that quarter familiar to every traveller. Like all the country about Jerusalem, this hill has a barren aspect, except during the spring, when it is covered with grass and flowers.

"The view from this hill is fine and extensive, embracing all the northern and western portions of the city, the Mosque of Omar, the two great synagogues, and the castle, or so-called Tower of David. The high land towards Bethlehem and in the south-west is visible far beyond the city. The city itself and its suburbs, lie spread out before us, and the hill itself is in full view from the Temple and all the

upper part of Zion. In the north we have Shafat, and over the ridge of Scopus the top of Tell el Ful, or Gibeah, appears. Scopus and the Olivet range bound the view in the east, and in the south-east rises the grand wall of the mountains of Moab. Although there is such a wide view, the hill does not seem high, nor is it more than forty feet above the level of the country about it. It is scarcely too much to say, that if a person wholly ignorant of any question in connection with the site of Calvary were asked to select a spot without the walls of the city for the public execution of criminals, the only two conditions being that the place should be a conspicuous one and convenient to the Castle of Antonia, he would not hesitate a moment in choosing this hill for that purpose."

Dr. Merrill adds: "One of the most certain identifications of modern times, is that of the Castle of Antonia as being located in the north-west corner of the present Haram area. Here soldiers were quartered to guard the Temple, and for other purposes; and here, also, criminals were confined, as, for example, the Apostle Paul, until final disposition could be made of them. As this was the most important castle of the city, and dominated the Temple, we can reasonably suppose that it would not be approached by narrow, winding, and intricate streets, but, on the contrary, that the road leading from it out of the town must have been direct, and one that was not ordinarily blocked by people or traffic. In

a word, the Castle of Antonia must have been approached by a direct road, which, in a special sense, would be regarded as a military road. Furthermore, as criminals were confined in this castle, we may suppose that the place of the public execution of criminals would be on the line of this road, near it, or at the most convenient distance from it, and in a conspicuous place, so that the executions could be witnessed by people standing at a distance, or upon the city walls. Again, it is not likely that the place of execution was changeable, one month here and the next month there, but we may suppose it to have been always the same. The permanency of the locality is a matter that can be taken for granted. We may suppose, further, that the Romans, when they came into power, would naturally select as the place of the execution of criminals that one which had been used as such by the Jews before them.

"Under the Convent of the Sisters of Zion, which is near the Castle of Antonia, but on the opposite side of 'Via Dolorosa,' there is, six or eight feet below the level of the street, some remarkably well-preserved ancient pavement, which hundreds of travellers have visited and admired. From certain indications we are led to believe that this pavement was connected with an ancient street that ran in nearly a direct line from Antonia northwards to the city wall. The most important military route of Palestine at the time of Christ was that which connected Cæsarea-on-the-Sea with Jerusalem, which

it approached from the north. At the point where the line of the street first mentioned, supposing such a street to have existed, touched the city wall, we find an old gate, closed at present, but bearing the significant name of 'Herod's Gate.' If the line of this street be extended beyond this so-called 'Herod's Gate' to the north-west, we shall find along it definite traces of an old Roman road. This we find to be identical with the great military road which connected Jerusalem with Cæsarea. It is perfectly natural to suppose that the place of the public execution of criminals would be somewhere on the line of this road. Between the castle and the fatal spot soldiers who guarded the criminals could move to and fro unobstructed. A little after this road leaves the wall at the point marked as 'Herod's Gate,' we find on the left hand a hill remarkable in form, noticeable from its position, and with which are connected some traditions respecting the execution and burial of criminals.

"Again, we find the name of St. Stephen connected with the western slope of this hill; here is the traditional place of his martyrdom; here a church was erected to his memory, which existed for nearly eight hundred years, and of which remains have been unearthed during five years past. It is not unnatural to suppose that St. Stephen was executed at the place of the public execution of criminals. The theory that our Lord was executed at the same place has the most valid reasons in its support.

There is current among the Jews in Jerusalem a tradition that this hill was the place of stoning, the 'Beth Has-Sekilah' mentioned in the Mishna. Likewise another tradition, that this hill was the place, or was connected with the place, of burial of those who had been publicly executed. The origin of these traditions I do not know, nor do I pretend to estimate the value of them. That they exist at all is a curious and, I should say, a significant fact, whether they are worth little or much.

"If Joseph of Arimathea, who was a wealthy man, had a private garden near the city, we may suppose with reason that it was in this direction, that is, to the north of the city, where were many gardens and country houses. The statement in John xix. 41, "in the place where He was crucified there was a garden; and in the garden a new tomb, wherein was never yet man laid," seems to be very explicit. If, on the one hand, we press these words literally, and on the other insist that our Lord was crucified in the place of the public execution of criminals, we make this place and the garden of Joseph of Arimathea to have been identical. The question arises, whether a man of position and wealth would have a private garden in such a place? But there is no real objection to supposing that the hill-top, which was easily accessible from the Roman military road, might have been devoted to the purposes of execution, and at the same time the ground about it, to the very foot of its slopes, to

have been occupied by private gardens. Such gardens might have surrounded the hill on the south-western, western, and north-western sides, and joined the Roman road on the north.

"The Roman road, which we have described as leading from Antonia through or near 'Herod's Gate,' skirted this hill at the foot of its eastern and north-eastern slopes. Some miles farther north this road divided, one branch going north to Nablous or Shechem, and the other, past Beth Horon, to Antipatris and Cæsarea-on-the-Sea. Along this road Paul, strongly guarded, was taken a prisoner to Cæsarea. With what emotions did the prisoner, as he left the city and passed this Golgotha hill, look up to the spot where the Master had died upon the cross?"

Dr. Merrill then refers to a tomb which I had the pleasure of visiting in his company. It is on the western face of the hill, in a low cliff; and its entrance is now partly buried with earth. Within, it shows a single chamber and a slab, which, though now displaced, must have formed a shelf or bench at one side. The entrance is of different character from that mentioned in the Gospels, but in other respects it is precisely the style of tomb into which we may suppose the apostles stooped down and looked on the morning of the Resurrection. The existence of this tomb, whatever its age and origin, realizes the fact of such tombs being in this hill, close to the place of crucifixion; and there may have

been many such, now buried, or removed by the operations of the quarrymen. It is also evident from the Gospel history, that the tomb of Joseph was of one chamber, with an open shelf to support the body of the dead, so that a person looking in could see the place where the body had lain, a fact which appears in the narratives of all the four Gospels, though in different connections. These points are of interest, as showing how precise the New Testament indications are, and how completely they have sometimes been overlooked by those who have compared large chambered tombs, or those with long oven-like receptacles for the dead, with the tomb of Jesus.

The hill referred to in the above remarks, and which we may call the "Skull Hill" (Fig. 38), was originally a part of the Moriah ridge, extending northward from it, as a short and narrow spur, and, had the city reached so far in the earliest times, might have formed an outwork for its defence. It contained, however, a continuation of the fine white limestone which underlies the Moriah ridge, and was the most convenient and accessible place for quarrying it. Hence a quarry was opened in it, we do not know at how early a date, but certainly, for a reason which will appear immediately, as early as the building of Solomon's Temple. The quarrying operations were finally extended quite through the hill, so as to separate the skull hill entirely from the remainder. This excavation was carried from the

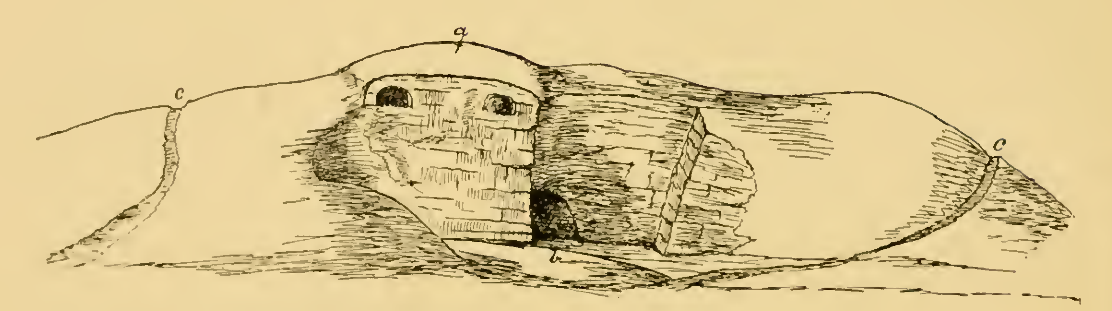


FIG. 38.—THE SKULL HILL, FROM THE MODEL OF GENERAL GORDON.

(*a*) Supposed place of the Crucifixion, on the brow of the Skull; (*b*) Jeremiah's grotto; (*c*, *c*) Roads leading around the hill from the Damascus gate. That on the right is near to the old Roman road leading from Herod's gate. For other views, showing the present state of the site, see "Egypt and Syria" (Religious Tract Society). The above is sketched from a model prepared for me, after that of General Gordon, by Mr. C. Paulus, of Jerusalem.

city wall on the one side to the interior of the so-called grotto of Jeremiah on the other, leaving only a round knoll to represent the former extremity of the ridge, and even this undermined extensively in the grotto of Jeremiah. The reason for leaving this remainder of the hill may have been the respect due to tombs excavated in it or buildings upon it; or merely because in this direction the best stone was giving out or coming too near the surface. In any case, the quarrying in this hill was abandoned, and the rock was followed underground in the great quarries under the Bezetha quarter of the town. In these quarries the bed of white limestone dips to the eastward at an angle of 10°; and the rock has been cut and excavated in a manner similar to that employed in the great Egyptian quarries. The total amount of limestone extracted from this quarry must have been very great—more than sufficient, one would imagine, to build all the substructures of the Temple and the Temple itself. These facts show that the northern city wall, long before the time of Christ, must have occupied its present site. If so, since the Crucifixion was "without the gate," it cannot have been where the Church of the Holy Sepulchre now stands; still less is it possible that the tomb of Joseph of Arimathea could have been in such a position.

Merrill gives a list of travellers who have held that this hill is the true Calvary. Perhaps the greatest credit is due in the first place to the German

scholar, Otto Thenius, who in 1849 pointed out its claims as the true Golgotha. In 1871, Dr. Fisher Howe published a detailed description and plan, illustrating this view; and Lieutenant Conder, in "Tent Work," 1878, advocates the same theory. The late General Gordon took much interest in the question, and had a contoured plan and model prepared to illustrate the topography, to which he referred in the Statement of the Palestine Exploration Fund for April 1885, and in his little work, "Reflections in Jerusalem." I have now before me a copy of General Gordon's model, executed in the Melekeh stone, similar to that of the hill itself, and which very well shows its characteristic features and position relatively to the city walls, and also the structure of the hill as composed of white limestone dipping gently to the eastward in the same manner with that of the great quarries. It also shows the ground as it would appear if denuded of Moslem buildings and enclosures, trees, etc. (Fig. 38). When I was in Jerusalem in 1834, I found Dr. Merrill, Dr. Chaplin, and other local authorities firmly convinced that the Skull Hill is the true Calvary of the Gospels. It is to be hoped that it may remain in its present desolate condition till the "times of the Gentiles" shall be fulfilled, and He who was crucified thereon shall return in His power to reign over a renovated world.

Note on the Hittites, or Khita, of Palestine.

There seems to be a general agreement that the biblical Hittites, or children of Heth, whom Abraham found in Palestine, are identical with the Cheta of the Egyptian monuments and the Khita, or Khatti, of the Assyrians; that they were a great and widely-distributed people, powerful in war and advanced in civilization in very early times, but waning even as early as the Hebrew occupation of Canaan. It seems further admitted that their language was of Accadian or Turanian type, rather than Semitic, and that in physique and costume they bore some resemblance to the populations of Northern Asia, while they possessed, at a very early period, the art of writing in a peculiar syllabic character. All these points, as well as the affinities of their language with those of Eastern Asia, and with certain American tongues, have been maintained by my friend, Rev. Prof. J. Campbell, of Montreal, for several years;[1] but have only recently been received with confidence by scholars in Europe on independent testimony. These results remarkably confirm the early biblical notices, and in all probability will eventually connect this ancient people, on the one hand, with the Hyksos invaders of Egypt, and on the other with the old populations of the later stone and early bronze age in Europe. In so far as Egypt is concerned, they render it probable that settlers of this race had penetrated into the Delta as early as the first settlements of the Egyptians proper, and that they were intruders only as re-inforced by their countrymen from the East, and carrying on aggressive wars. In Palestine they are identified in the Bible with the children of Canaan, as probably the most extensive branch of that stock. The Canaanites seem thus to have been mainly Turanian, though probably mixed with Semitic blood in some, at least, of their tribes. It is also probable that the Egyptians and Assyrians may have included under the general names of Cheta and Khatti confederacies of tribes like those mentioned in Joshua (chapters 9 and 11), and in which the Hittites proper constituted merely a part, though usually, perhaps, a leading one.

[1] Proc. Soc. Bib. Archæology, 1881. Am. Association, 1883, etc.



Egyptian Water-girls of Thebes.
(From a photograph by Count Lynar.)

CHAPTER IX.

RESOURCES AND PROSPECTS OF BIBLE LANDS.

The real magnitude of countries may depend, not so much on their number of square miles as on the greatness of the events that have occurred in them, and their influence on the affairs of the world. The cultivable land of Egypt is a strip along the Nile, not over 10,000 square miles in area—scarcely twice as large as the valley of the Thames, and not much larger than Yorkshire. Palestine, only about 120 miles in length, and shut in between deserts and the sea, and largely composed of rocky hills, has scarcely a larger amount of cultivable land, and this not equal in quality to the rich alluvium of Egypt. Yet these two countries are in many respects the most important in the ancient world. The science of Egypt and the religion of Palestine still, to a great extent, rule the destinies of men, low though these countries have themselves fallen. It is true that these little countries are exceptional in their productiveness and capacity for supporting a large population. This is well known with regard

to Egypt, where the fertility of the land is proverbial, and where we can see fields that have been cultivated for 4,000 years still rejoicing in all the exuberance of virgin fertility. Of Palestine it is not so generally believed; for Palestine, to the ordinary traveller, appears, especially in the drought of summer, a bare and barren country. Yet the climate and rainfall of Palestine, with the chemical quality of its rocks and soils, rich in lime, alkalies, and phosphates, render it productive to a degree which cannot be measured by our more northern lands.[1] Its plains, though limited in extent and often stony, have very fertile soil. The olive, the vine, and the fig-tree will grow and yield their valuable fruit in abundance on rocky hills which at first sight appear barren and worthless. Whenever culture has been undertaken with skill and vigour, it has been well rewarded. A little study of the work done, for example, by the German colonists in the stony land near Jerusalem, suffices to show the great capabilities

[1] According to Dr. Post, the mean annual rainfall at Beyrout is 35·66 inches. It diminishes to the southward, being 22·96 inches in Judea. The proportion of rain in the winter months is variable, and upon this largely depends the harvest. The "early rain" of September is very important, softening the ground and enabling the farmer to plough and sow. The "latter rain" of March to May keeps up the moisture in preparation for the drought of the summer months. The temperature ranges from 35° to 100°, the annual range being only about 65°, and the changes usually slow and gradual. This gives for practical purposes a very favourable climate, which is capable of improvement by planting.

of the soil. In the olden times the Tirosh,[1] as the Hebrews called the fruit of their hill orchards and vineyards, was one of the main sources of wealth; and the vineyards, with the vines trailing over the warm rocks and clothing the ground with their leaves and fruit, realize the prophetic description of hills running with the grape juice, and of a land flowing with milk and honey, if by the latter we understand the "dibs" or syrup of the grape. In Palestine a few olive-trees on a rocky hill, that in colder climates would be worthless, may maintain a family. There is also an abundance of nutritious pasturage, more especially for sheep and goats, all the year round, on the limestone hills. In the present political condition of the country, it is true, these advantages are neutralized by bad government, or by robbery under the name of government. The cultivator is plundered to an unlimited extent under the guise of taxation; and for this he has no equivalent, either in protection to his life or property from other robbers or in any material improvements in his country. Every improvement he may himself make, either in planting or otherwise, is only an excuse for more severe taxation. Hence there is little inducement to progress of any kind, except in the case of foreign settlers protected by their own consuls. Wherever protection of this kind can be obtained, the country begins to show signs of pros-

[1] Often incorrectly translated "wine."

perity. Elsewhere the incubus of Turkish misgovernment kills all advancement.

Palestine must originally have been a well-wooded country, and its forests are mentioned in the historical books of the Bible; but they have for the most part perished, and this has tended to make the climate more arid. The wild hill-sides are, however, often covered with an exuberant growth of bushes and young trees, which, if permitted to grow, or if replaced by cultivated trees, would soon clothe the land with verdure, and tend to produce a more abundant summer rainfall. With just laws, well administered, there is nothing to prevent Palestine from becoming as wealthy and populous as we learn from the Bible it was in the days of the Jewish kings, and as it seems to have been at a later time under the Roman government.

In a geographical point of view, Egypt and Syria are the key of the East; and one sees evidences on every hand of the anxiety of the leading European nations to gain a dominant influence in their affairs. England for the moment has the upper hand in Egypt; but her influence there is hated with the utmost bitterness by other nations, and especially by France. In Syria, the agents of France, Germany, and Russia are watching each other, and each eagerly embracing every opportunity to gain a little in political or religious influence, or in territory and buildings. So important are these interests becoming, that they may at any time afford a pre-

text for interference or occupation; and it is not impossible that the inevitable battle between the civilization of Europe and the lowering cloud of Russian ascendency may yet have to be fought on the old battle-fields of Syria.

The time was when the political importance of Palestine was ostensibly based on the religious sentiment connected with certain holy places,—an influence no doubt still operative,—and when that of Egypt depended solely on certain financial questions in connection with its productive soil. Now the great international thoroughfare of the Suez Canal and the prospect of railway communication through Syria to India and China, have given an immense additional value to these countries in the eyes of the European nations. To Britain more especially the freedom of the Canal has become indispensable; and the time is near when her possession of India will depend on land communication by railway from Egypt or Syria.

England makes little show of active work in Palestine; but her possession of Cyprus and Egypt makes her influence great, and at this moment England and the United States have probably a greater moral power over the peoples of the East than any other nations; and however separate these two great nations may be politically, the identity of their language, religion, literature, and free institutions, and their wide-spread commercial enterprise, make them one in the view of the Eastern people,

who, under the now prevalent impression that the time of the Turk is approaching its end, watch eagerly every movement of their Western friends, whom they are just beginning to understand. In one of our excursions in Egypt, an intelligent native seemed to recognise some shade of difference in our party, as compared with other English-speaking people. At length he asked, "You English?" My wife, to whom the question was addressed, answered in the negative. "You Melican?" was the next inquiry; and the answer was the same. He was puzzled. "What you?" he asked; and the reply was, "Canadian." Here was food for thought to him, but his only remark was, "Ole man," meaning myself, "like Melican." I have no doubt that the Canadian and Australian contingents in the Egyptian campaign of 1885–6 were recognised by the people as new and additional members of the multitudinous English-speaking nationalities, which they begin to think encompass them on all sides, and occupy all the ends of the earth.

In a certain sense Egypt and Palestine are complementary countries—the one the land of palms and grain and cattle, the other the land of vines and fruit-trees and flocks. The traveller in Egypt sees vast fields of grain, sugar-cane, cotton, forage crops and beans, with groves of date-palms, and in the upper country, above Abydos, the beautiful doum palm, while the principal domestic animal is the great ungainly buffalo. The visitor is also struck

with the absence of wild vegetation, every inch of fertile ground seeming to be under cultivation, and every weed collected and used for some useful purpose by the people. In Palestine, on the other hand, the country is gay with flowers, especially in early spring, and the conspicuous objects of culture are the vine and the olive. Even in the plains, cultivated fields are few, and much is merely wild pasture. The palm-tree is rare, though it still grows in the plain of Jericho and the sheltered valleys throughout the country, yielding dates smaller than those of Egypt, but of very pleasant flavour. In their primitive state the two countries were perhaps more similar than at present. Both were wooded and while the trees and plants of Africa must have spread along the Jordan valley and the maritime plain, many of the Asiatic plants no doubt found congenial habitats here and there in the north of Egypt. But all this has been changed under the *régime* of man; and the dissimilarity has become so great, that the two countries offer markets for the produce of each other, a reciprocity which might be greatly extended, were Palestine better governed.

All over Northern Africa and Western Asia the Arabic has replaced the Greek as well as the older Semitic tongues, ever since the irruption of the followers of Mahomet from the abyss of the desert; and the Koran, the sacred book of the Arab, has replaced all other literature. The close affinity of the Arabic with the other Semitic languages, and

the not very remote distance between it and the Coptic, have facilitated the change. But now that the Mohammedan power is in a state of decay, and that the Arab power has given place to that of the Turk, whose language is Turanian rather than Semitic, and shows no power to replace the Arabic, the question arises whether the latter can be made the instrument of a higher culture, or whether it can be replaced by any European tongue. In the American College at Beyrout the Arabic takes a high place, though English is also taught. Some young men, graduates of the College, were conducting a scientific Journal in that language, in which a popular lecture which I delivered in Beyrout, on the Geology of the Lebanon, was reported. The Arabic edition of the Scriptures issued from the Beyrout press, and the many useful books, not merely religious but scientific and literary, issued thence, are doing much to bring the Arabic into the circle of modern civilized languages. On the other hand, there is a strong disposition on the part of the native population, and especially the Christians, to adopt the languages and culture of Europe. But what language shall they learn? In Egypt, several circumstances have given a temporary preference to the French; and the Jesuit missionaries, supported by the French Government, which, to use the caustic expression attributed to the late Paul Bert, keeps its religion, not for home consumption, but for exportation, are making strenuous efforts to secure pre-

dominance in Syria. On the other hand, the English occupation of Egypt and the educational work of the American and English missionaries, have given a wide diffusion to the English language. The lecture at Beyrout, already referred to, was in English, and the audience, I should think of three hundred persons, many of them natives, were quite capable of understanding it. At a Sunday evening meeting in the College, attended by perhaps 150 students, the hymns and addresses were indifferently in Arabic and English. Cypriote students come over to Beyrout expressly to learn English. English is taught in forty or more schools of the missionaries up and down the Nile, and in large Coptic schools in Cairo, and there are about 2,000 pupils in missionary schools in Syria. We found native boys, as far up as Luxor, able to read English and glad to get English books; and it was remarkable to see how many of the natives had picked up a smattering of the language.

The two Theban water-girls, whose portraits appear at the beginning of this chapter, are representatives of Egyptian fellaheen children, descendants of people who were civilized when our ancestors were savages, and who are full of life, grace, energy, and womanly tact, ready to be developed under kindly Christian influence into something better than the dreary slavery of the Moslem women. These girls accompanied us over the flinty tracks of the Valley of the Kings, running all day with bare

feet, and carrying their jars of Nile water to supply the thirsty traveller, for a pittance which one was ashamed to offer as the payment for so much toil, care, and intelligence. One of them, when her services were declined by my wife, expressed her disappointment in broken English, fairly well pronounced:—"What for you no want Fatima—good girl Fatima—you much rich lady." I have placed them at the beginning of the chapter, to plead for the women and children of Egypt and Syria with those Western Christians whom God has so greatly enriched, and to commend to their aid and sympathy the self-denying men and women who are labouring for the elevation of these poor people.

There can be no doubt that if France should gain the political predominance which it seeks in the Eastern Mediterranean, it will adopt the same policy which in the Polynesian Islands expels missionaries and teachers who will not teach exclusively in French; and that, while not over friendly to the Church at home, the Government will lend its countenance to Roman Catholic missions abroad, provided they teach in French and promote French ascendency. The English Government employs no such means, and the United States extends to American missionaries only such protection as it is bound to afford to any of its citizens abroad. But the Protestant missionaries have the great advantage of offering an education in harmony with the wants of the time, and of having the Bible to give

to the people in their own languages. A religion without a sacred book is apt to be regarded with contempt both by Mohammedans and Eastern Christians, and this has been the condition of the Roman Catholic missionaries until lately, when an edition of the Arabic Bible, with some explanatory notes, has been prepared by them in self-defence.

Perhaps the greatest disadvantage of the English arises from the character of its pronunciation and the imperfection of its alphabet. The Oriental languages are largely guttural, while English is very much a language of the lips and palate. Any one who has tried the experiment of teaching an Arab to say "Yes," and has found, after many attempts, such sounds as "aas," "aws," "yaas," the nearest approximation to it, can appreciate this difficulty. The imperfect character of the English alphabet is another drawback, and interposes great difficulties to the Eastern student. It would, I think, be well if the teachers of English in the East would adopt a phonetic alphabet, as a means at least of overcoming preliminary difficulties; and it would also be desirable to absorb as many native words as possible for native things, as has been done to some extent in India.

We met in Jerusalem an agent of the Bible Society, Mr. Lethaby, who has travelled through a large part of Syria, and concurs in the statement made by missionaries that there is a great desire for education among the native peoples, especially the

native Christians. He has circulated, at the time of the great feasts at Jerusalem, as many as 2,500 copies of the Gospels, in nineteen languages, to pilgrims of many nationalities and sects. Thirty or more Bible women are now engaged in similar work in Syria, and medical missionaries, male and female, and medical doctors, trained at Beyrout, are now being established in many places. All this, and much more, is preparatory work for better things in these old lands; and in the meantime it promotes the spread of the English language and of Protestantism.

On the whole, the most hopeful element in Syria and Egypt is that of the native Christians. There are supposed to be sixteen millions of these in the Turkish Empire, belonging mainly to the Coptic, Greek, Armenian, and Maronite Churches; and the Druses of the Lebanon, though not Christians, are favourable to Christian culture and influence. The Jews also are an important element, and I believe have by late events not only been induced to reside in greater numbers in Palestine, but to be more amenable to Christian influences. However debased politically, and however corrupt in regard to religious doctrine, the native Christian is altogether a superior style of man in comparison with the Moslem. He represents the independence and obstinacy which have clung to an idea through ages of persecution, and he has some respect for woman, and is not a fatalist; and now, when he is beginning

to hope that his long slavery is approaching to its end, he looks to the more free and enlightened Christian nations as his natural friends and allies. We, on our part, should not forget our old obligations to the East, and should be ready to repay them with interest.

That the future of these old lands may be more important than their present, it requires little penetration to see; and the old Book, whose history of these lands in the past we have been considering, has something to say of their future as well. Whatever belief men may repose in prophecy, they cannot doubt that the word of God has committed itself to certain foreshadowings of the future; and though some of these are shrouded in a symbolism to which varied interpretations have been given, others are sufficiently plain. I shall refer here only to two, which are however of great significance, especially when taken in connection with each other.

In that prophecy of Jesus (Luke xxi.) in which He warns His disciples of the approaching downfall of Jerusalem and the Jewish institutions, He remarks: "Jerusalem shall be trodden down of the Gentiles till the times of the Gentiles be fulfilled." Those times of Gentile dominion to which our Lord referred had existed since the rise of the Babylonian empire, were still going on, but were destined to end at a fixed time, when they should be fulfilled. Daniel had indicated long before, this end of the times of the Gentiles at the close of the term

allotted to his fourth empire, and the powers that should immediately succeed it, or arise out of its dissolution.[1] More than eighteen hundred years have passed away since these words were spoken. Jerusalem is still trodden down of the Gentiles; but is their dominion to last for ever? Are there not already manifest signs of the destruction of the powers, political and ecclesiastical, which now represent the Gentile domination? The time may be very near, or it may be further delayed; but when it comes, if the prophecy is true, Jerusalem, and that which Jerusalem represents, will rise on the ruins of those Gentile powers by which the old city of God is now trodden down.

Another topographical intimation, closely connected with that of our Saviour, is contained in the Apocalypse of St. John. It appears as a note in the prediction of the seven angels who were commissioned to pour out the vials of God's wrath on the followers of those powers succeeding that which in John's time reigned on the Palatine, and whom he designates as "the dragon, the beast, and the false prophet." These evil rulers are said, under the vision of the sixth vial[2] to send out three emissaries whose function it is to gather the kings of the whole world (*oikoumene*, the inhabited world, which with John means the Roman empire and its dependencies) for apparently a great final struggle for existence. The note on this is—"they gathered

[1] Daniel ii. 40. [2] Rev. xvi. 12–16.

them together into a place which is called in Hebrew Har-Magedon," that is, the mountain of Megiddo; and the purpose is, that they may fight the great battle of God Almighty. It is to be observed here that the name of God (equivalent to El-shaddai of the Old Testament) is that by which He is said to have been known to the patriarchs before the time of Moses,[1] so that this war or battle has nothing to do with Christianity as such, though in some sense no doubt a religious war. But the point which especially concerns us, is the locality of the struggle. That old pass across the neck of Carmel into the Esdraelon plain, which was the chosen route of all invading armies passing north and eastward from Egypt and the plain of Philistia and Judea, and in like manner the way of access of the Euphratean kings proceeding westward to Egypt, is the predestined locality of the great contest which is presumably to end the times of the Gentiles, and to prepare for the rescue of Jerusalem and Palestine. The prophet may mean that the Gentile powers are literally to meet each other in hostile array on this old battle-ground; and there can be no doubt that in any struggle for what is now Turkey in Asia, no locality is more likely to be selected to meet an invader, either from the North or from the South. But the locality may be merely symbolic, and may mean whatever place in the Roman world is relatively to it, like the pass

[1] Exodus vi. 3.

of Megiddo relatively to Palestine. Whichever view we take, our mental vision is directed to the old Palestinian battle-field, if we wish to understand the meaning of the prophet; and, whatever his precise meaning, the prophecy certainly relates to a great contest preceding the fulfilment of the times of the Gentiles, and the rescue and restoration of Jerusalem and the old lands of the Bible. What the features of this struggle may be we can scarcely at present imagine. We know, however, that physically these lands are still young, and capable of greater things than those of the past, and we may content ourselves with repeating the inspired words of an older Jewish prophet:—

> "For the Lord will comfort Zion:
> He will comfort all her waste places,
> And will make her wilderness like Eden,
> And her desert like the garden of the Lord:
> Joy and gladness shall be found therein,
> Thanksgiving and the voice of melody."[1]

[1] Isaiah li. 3.

APPENDIX.

SPECIAL NOTES ON THE GEOLOGY OF EGYPT AND PALESTINE.

I. GEOLOGY OF THE NILE VALLEY.[1]

1. *Raised Sea Margins.*

SHORTLY after my arrival in Cairo, Dr. Schweinfurth, of that city, was so kind as to conduct me to a remarkable sea-terrace at the foot of the Mokattam hill, behind the tombs of the Caliphs, and stated on the authority of Col. Ardagh, R.E., to be at an elevation of about 200 feet above the level of the sea, and which, I believe, was first described by Oscar Fraas. At this place a cliff of hard eocene limestone, about thirty feet in height, has been perforated by *Lithodomi*, whose burrows are now filled with grey calcareous deposit; and valves of a small species of oyster are also attached to the surface of the rock. The burrows resemble those of an ordinary Mediterranean species of *Lithodomus*, but I did not see the shells. The oyster has been described by Fuchs, as a new species, under the name *O. pseudo-cucullata*; but, according to Dr. Schweinfurth, it does not seem distinguishable, except as a variety, from *O. cucullata*, Born. (= *O. Forskali*, Chemn.), of the Red Sea. Since the locality was observed by Fraas, Dr. Schweinfurth has discovered other shells in the crevices of the rock, more especially a *Pecten*, a *Terebratula*, and a *Balanus*, all modern species. The recent character of these shells and their mode of occurrence and state of preservation, oblige us, I think, to assign them to the Pleistocene, or at farthest the

[1] The substance, in part, of the following notes was published in the *Geological Magazine* of London, 1884.

later Pliocene period, though I am aware that they have been regarded as Miocene.

Shortly after visiting this place, I was so fortunate as to discover on the opposite side of the Nile a similar exposure, distinct apparently from any of those referred to by Fraas, associated with an old sea beach, which I subsequently examined more carefully in company with Dr. Schweinfurth. It occurs at the summit of a rocky knoll, called by the Arabs

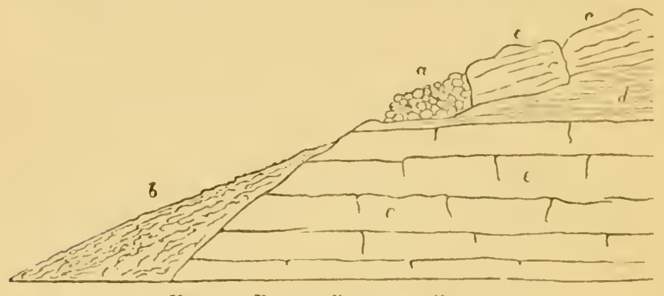


FIG. 1.—RAISED BEACH AT GIZEH.
(*a*) Beach. (*b*) Sand. (*c*) Brown Limestone. (*d*) Clay and Marl. (*e*) Limestone.

Het-el-Orab, or the Crow's Nest, a short distance to the south-west of the pyramids of Gizeh, and separated from the plateaux of the pyramids by the depression which contains the sphinx, and which is partly natural, but in great part produced by excavation, of which evidences exist not only in the remaining



FIG. 2.—MOKATTAM TERRACES FROM THE NILE.

chips of stone, but also in the sphinx itself, and in the tomb crowning an isolated mass of rock farther to the west.

I may remark here, that in the vicinity of the pyramids the great succession of Eocene beds, 600 feet in thickness, which,

in the Mokattam hill, appears in a perfectly regular manner,[1] has been so affected by lines of fault that some of the higher beds are brought down to a comparatively low level, and consequently in the Het-el-Orab a portion of the series which in the Mokattam is at a height of at least 400 feet, descends to an altitude of about 160 feet above the sea-level. The throwing down in this way on the Lybian side of the Nile valley, in contrast with the comparatively undisturbed condition of the beds on the Arabian side, has no doubt borne an important part in determining the present position of the river. The Nile valley, in short, occupies a north-and-south dislocation, not unlike, though inferior in amount of down-throw and upthrow, to that of the Jordan valley, described in the text.

The side of the Het-el-Orab next the pyramids presents

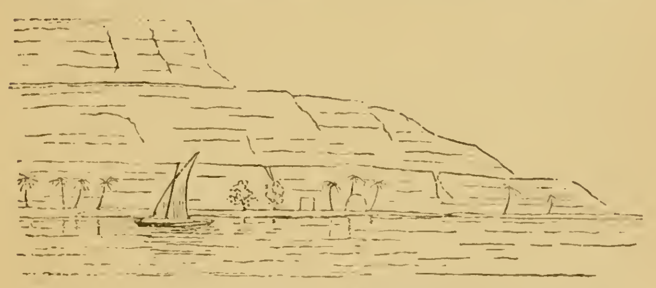


Fig. 3.—Terraces in Eocene Limestone above Assiout, on Arabian Side of the Nile.

a vertical quarried face, with a slope of *débris* below, and at top some beds of marl and gypseous clays, surmounted by coarse limestone containing Upper Eocene fossils, for the identification of which I am indebted to Dr. Schweinfurth. On the opposite, or south-east side, the hill is in its natural state, and shows a sea-worn cliff, in which the upper hard beds have been partially let down and disturbed by the undercutting of the marls and clays beneath them. Here the edges of the limestone have been perforated with *Lithodomi*, and are covered with oyster-shells, often showing both valves in

[1] Schweinfurth, "Proc. German Geol. Survey," 1883.

contact, and better grown than those in the locality of the Mokattam. There are also a few *Balani*, but we observed no other species. Under and against the edges of the rock has been piled a very coarse sea-beach, composed of rounded fragments of limestone, with a few basaltic-like pebbles not native to the locality. The interstices of these are often packed with loose oyster-shells. The pebbles of the beach are somewhat cemented together by calcareous matter, but otherwise the whole is as fresh as if only recently deserted by the sea. The old beach has however been cut by subsequent aqueous erosion since it became consolidated, as it now stands on the side of the cliff with a vertical face about forty feet above the sandy plain below.

A little way over this plain to the southward are the well-known beds containing *Clypeaster Ægyptiacus*, *Pecten benedictus*, and *P. aduncus*. Dr. Schweinfurth has recently found *O. Forskali*, and other modern species in these beds, which he states in some places pass into a solid breccia. He regards their age as probably Pliocene, and I have little doubt that they belong to the same sea-bottom with the beach of Het-el-Orab, and are of Later Pliocene or Pleistocene age. I am aware that they have been regarded as Miocene, but the evidence of the fossils is against this. Dr. Schweinfurth informs me that ancient Egyptian tombs have been excavated in the breccia associated with the Clypeaster beds.

It is evident that the submergence indicated by these sea-margins would with the present levels carry the sea far up the Nile Valley, as the top of the Cataract at Assouan is only 300 feet above the sea-level. I noticed at various points on the Nile as far up as Silsilis, a terrace corresponding with the height of the raised beaches, and probably a continuation of the same shore, indicating that in the Pliocene or Pleistocene age the Nile valley was an arm of the sea. Dr. Schweinfurth has noticed, in a paper of more recent date, the occurrence of similar deposits much farther up the Nile, at Seedment, near Beni Ssuef, which is precisely what I would have anticipated.[1] With this submergence I would also associate the older beds

[1] "Proc. Berlin Geol. Soc.," January, 1886.

of consolidated gravel seen at Thebes and elsewhere in the Nile valley, and the transport of boulders from the hills east of the Nile into Lybia, as seen at Denderah.[1] The Theban gravels above referred to are those in which flint flakes supposed to be of human workmanship were found by General Pitt Rivers. If really of this origin, they would prove the residence of man in Egypt at a time when only the higher parts of the country were above the level of the sea. For reasons stated elsewhere, however, I doubt very much whether they can be attributed to man.[2]

We may also connect this recent submergence with the sandstones and raised beaches holding modern shells in the vicinity of Alexandria and of the Red Sea, and with the similar sandstones of the maritime plains of Syria, which near Jaffa and at Beyrout attain to elevations of about 200 feet. We thus have evidence of a very extensive Pleistocene submergence, extending all around the eastern end of the Mediterranean. It is limited in date by the Middle Tertiary on the one hand, and by the elevated land of the Post-Glacial on the other, and was not improbably coincident with that great submergence of the Pleistocene which affects so generally the northern hemisphere.

There is, I think, evidence at Cairo that this submergence was in its earlier period of still greater magnitude. The elevation of the Mokattam hill is 640 feet, and it consists of slightly inclined Eocene deposits, the lower part of which are for the most part pure marine limestones, while about one-third of the upper part consists of coarse brown limestone, with marly beds and clays. At the height at about 500 feet, and near the junction of these two members, there is a broad flat terrace, especially on the western side; and though no marine shells have been found on this, it is scarcely possible to pass along it and examine its bounding cliffs and caverns, without being convinced that it has been produced by

[1] Newbold notices these, "Journal Geological Society of London," vol. iii. I saw numbers of these boulders scattered around Denderah. They seemed to be crystalline rocks from the Arabian range, and if not drifted by ice, must have been washed along a coast-line now removed.

[2] "Trans. Victoria Institute," 1884.

surf erosion. The continuation of this terrace may be observed here and there along the Nile as far as Assouan, beyond which place I had no opportunity to trace it. With this second terrace, older no doubt than that at a lower level, I would connect the denudation of the probably miocene sandstones containing silicified trees, of which Jebel Ahmar, near Cairo, is a remnant, and also the denudation of the Judean hills and the lower slopes of Lebanon, and the higher marine terraces of the Red Sea.

In contrast with these evidences of subsidence, I may now refer to the fact that at a later date, and more immediately preceding the historic period, the land of Egypt was probably higher than at present. The occurrence of patches of sand projecting through the Nile mud of the Delta, noticed long ago by Newbold, and the fact, ascertained by the recent borings by Col. Ardagh, that at a depth of 30 to 40 feet the alluvial mud of the Delta in some places rests on deposits largely composed of desert sand, show that in post-glacial or early modern times the plain of the Delta was a part of the desert, through which the Nile probably ran in a narrow and deep channel, and more to the eastward than at present.[1] A subsequent slight depression near the beginning of the historical period placed it in a position to receive and retain the inundation mud. This, with the further protection afforded by the line of raised beaches along its northern edge, rendered the formation of the Delta easy, and enabled its alluvial soil to be deposited in a much shorter time than would have been required had the Nile poured its deposits into a maritime bay of considerable depth, and unsheltered on its seaward side.

2. *Tertiary Deposits Later than the Eocene.*

The mass called Jebel Ahmar, or the Red Mountain, near Cairo, whose slopes consist of an immense accumulation of quarry rubbish, is composed of hard brown, reddish, and white

[1] The fresh-water deposits found in the central part of the Isthmus of Suez may belong to this period. See also the discussion of this point in the text, and extract from "Judd's Report," *infra*.

sandstone and siliceous conglomerate. In many parts it has the characters of a perfect quartzite, and appears at first sight extremely unlike a member of the Tertiary series, newer than the comparatively soft and unaltered Eocene beds on which it rests, apparently in a comformable manner, though its dip to the N.E. is somewhat irregular, and apparently affected by false bedding. The induration of the beds seems to be local, and to be connected with certain fumerole-like openings which have probably been outlets of geysers or hot siliceous springs, contemporaneous with the deposition of the sand.[1] Zittel, I believe, first gave this explanation, which suggested itself to me before noticing it in his memoir.

This mass is evidently a remnant of a formation at one time extensively distributed in this part of Egypt. This is shown by the fact that silicified trunks of trees, whose natural bed is in the lower part of this formation, near its junction with the underlying Eocene, are found scattered over the surface, not only in the great and little "petrified forests," but at Helouan, and even on the Lybian desert, on the opposite side of the Nile. Only the portions locally indurated by siliceous waters have escaped denudation, and it is the irregular appearance presented by these that has given the vague idea of a volcanic origin of these masses to so many travellers.

There has been much speculation as to the mode of deposition of the silicified wood;[2] but I think the study of it, as it exists *in situ* at Jebel Ahmar, is sufficient to set them at rest. It occurs in prostrate trunks, sometimes flattened and imperfectly preserved, and sometimes perfectly silicified, and occasionally lying in disintegrated cuboidal fragments, showing that the wood was imbedded in its natural state and in a decayed condition, and afterwards silicified. I consider the appearances decisive as to this point.[3] On the other hand, I could see no evidence that the trees are actually in the place of their growth. There seemed to be no "dirt-bed" or fossil

[1] Zittel, "Lybischen Wuste."
[2] Schweinfurth, "Proc. German Geol. Soc.," 1883.
[3] Newbold, "Quart. Journ. Geol. Soc.," 1848, vol. iv., states the same conclusion, p. 353.

soil. It seems probable, therefore, that the sand which was ultimately derived from the crystalline rocks of the interior, and perhaps proximately from the waste of the Nubian sandstone and the sandy Upper Eocene beds, was deposited in the vicinity of a wooded coast, or at the mouth of a river flowing through a wooded country, and that the trees are drift trunks imbedded in it. Their silicification is no doubt due to the presence of the siliceous springs to which the sand itself owes its induration. These springs, and perhaps also to some extent the deposition of the sandstone itself and its contained trees, may have been indirectly connected with the Tertiary volcanic phenomena which Schweinfurth has discovered[1] elsewhere in Lower Egypt. The thickness of these sandstones near Cairo must be about 100 feet.

The fossil wood of Jebel Ahmar and the petrified forests has been examined and partially described by various authors.[2] It includes several species of *Nicolia*, also conifers and a palm. Its affinities have been discussed by botanists, and it may be regarded as an African flora allied to that of the Soudan, and not improbably of Miocene age.[3]

It may be worthy of remark, that while this hard sandstone is now used only for millstones and for macadamizing the roads, it furnished to the ancient Egyptians the material of some of their most enduring sculptures. A curious shrine with a sphinx in the centre cut out of the same block, found in the temple of Tum at the site of the ancient Pithom, near Ismalia, is of this stone. Two large sacrificial tables in the Boulak Museum are of the white variety of the same stone, and are remarkable examples of the working on a large scale

[1] Beyrich, "Proc. Royal Acad. of Berlin," 1882.

[2] R. Brown, "Quart. Journ. Geol. Soc." iv. Carruthers, "Geol. Mag.," vol. vii. p. 306. Unger and Schenk,—Zittel, "Lybischen Wuste." The latter writers, besides *Nicolia Ægyptiaca* and *N. Oweni*, name five other dicotyledonous trees, *Acacioxylon antiquum*, *Laurinoxylon primigenium*, *Capparidoxylon geinitzii*, *Dombeyoxylon Ægyptiacum*, *Ficoxylon cretaceum*. They place also in this list *Araucarioxylon Ægyptiacum*, which seems rather to belong to the Nubian sandstone. The only conifer I have found among my Egyptian Miocene specimens is a species of *Taxites* not very remote in structure from the modern ginkgo.

[3] Schweinfurth, "Proc. German Geol. Soc.," 1883. Carruthers, "Geol. Mag.," xii. 306.

of a perfect quartzite. One of the colossi in front of the south propylon of Karnak is a monolith of similar material. Each of six colossi in front of this propylon was made of a different kind of stone, representing quarries in different parts of Egypt; and the one sculptured in this hard and refractory rock shows the bands of flint pebbles cut through and polished, along with the paste, which is nearly as hard as themselves.

The convenient name of "nicolia sandstone" has been bestowed on this formation by Zittel. Its relation to the underlying Eocene beds appears in the section Fig. 4, which also indicates the supposed outlets of hot springs and the horizon of the silicified wood, which, when laid bare by the denudation of its matrix, constitutes the so-called "petrified forests" of the deserts near Cairo.

Zittel has described extensive areas of Miocene deposits in

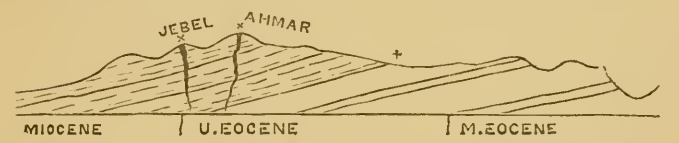


Fig. 4.—Relation of the Miocene Sandstone of Jebel Ahmar to the Eocene of the Base of the Mokattam Hill.
(× ×) Supposed Geyser pipes. (+) Horizon of fossil trees.

the Lybian desert west of the Nile; and in the neighbourhood of Jebel Geneffeh, north of Suez, Fraas has found similar beds, but which do not appear to be very extensive in their distribution, being apparently limited to the district between Cairo and Suez. I had no opportunity to study these formations; but their chief point of interest appears to lie in the fact that they occupy low grounds resulting from the partial removal of the Eocene, which seems to have experienced both elevation and marine denudation before they were deposited. These Miocene beds have sometimes been confounded with the raised beaches and terraces holding *Ostrea Forskali*, and with the *Clypeaster* sands near Gizeh; but these, as already stated, are probably somewhat newer.

Another deposit, also newer than the Miocene, is that which

occupies the highest part of the Isthmus of Suez, immediately north of Ismalia, and which has been described by Fraas and Le Vaillant.[1] Though occupying a narrow space at the Isthmus, these deposits extend to a considerable distance east and west, and as they are overlain at both sides of the Isthmus by more modern beds, may be of greater breadth than appears at the surface.

As they occur near Ismalia, and in the cuttings on the Canal between that place and El Gisr, they consist of thin-bedded grey limestones with vermicular holes, in horizontal beds, and resting on marls, sands, and clays, with gypsum and nodules of chalcedony. The greater part of these beds are destitute of fossils; but in, or associated with, the series, there are layers holding freshwater shells, more especially *Ætheria Caillaudi*, Férussac, a species now confined to the Upper Nile, but which has been found by Le Vaillant in these deposits, as far south as the cutting on the Suez Canal at Shaluf el Terraba, and which I also saw north of Ismalia. This formation would seem to imply the discharge of the Nile, or a considerable branch of it, to the eastward, and this not into a marine estuary, but into a saline lake, or a lake at some times salt and at others fresh. The greater part of these deposits indeed greatly resemble those occurring in the elevated terraces of the Dead Sea. The deposition of these beds would also seem to have occurred at a time of continental elevation, when the Isthmus was represented by a wide extent of land, and during the prevalence of a warm climate.

The date of these beds must be placed between the Miocene period and the modern Red Sea and Mediterranean marine deposits which flank the Isthmus on the south and north. But within these limits we have two continental periods to decide between—that of the Pliocene and that of the later Pleistocene or Post-Glacial. Between these periods there does not seem at present any certain evidence to decide; but perhaps the modern character of the fauna, so far as it goes, may rather incline the balance to the later one. In this case we

[1] "*Aus dem Orient;* Bul. Geol. Soc. of France," vol. xxii. 1868.

should have a fact pointing to the solution of the difficulties felt by Lartet and Günther respecting the identity of Jordan and Nile fishes. We should at least be in presence of a state of things in which the outlets of the Nile and the Jordan would be much nearer together than at present.

Since these "Isthmian" beds, as we may name them for convenience, have been laid down, a submergence has occurred in which the modern sandstones and clays which flank them were deposited, as those of the Red Sea at least rise to heights nearly as great as that of the Isthmian beds themselves. As seen near Suez, these beds, some of which have been sufficiently consolidated by infiltration to form a serviceable building stone, consist of ordinary and pebbly grey sandstones, holding modern shells, still retaining their colours and animal matter, on which are, in places, marls and clays holding gypsum and salt. Though some of these beds are as much as forty feet above the sea, others are at the sea-level, and may be still in process of deposition, more especially as certain low areas of the desert are covered with salt water, and receive additional deposits in high tides accompanied with storms, during which, I was informed, large areas of desert south of Suez are overflowed by the sea. Between Suez and Jebel Attaka we rode over extensive tracts of low desert, which we were assured were occasionally overflowed in this way. These desert surfaces were in many places strewn with recent shells, while workmen were quarrying, at and near the sea-level, modern sandstone holding similar shells, and which was being employed in building a pier at Suez.

Under this head may be mentioned certain igneous rocks of age later than the Miocene, described by Zittel, as existing in the Lybian desert west of the Nile, and by Schweinfurth in the country north-east of Cairo, near Abou Zabel, and to which I have referred above. This eruptive rock is described as a basalt or fine-grained dolerite with olivine,[1] and may be of the same age with the basalts of the Hauran and Dead Sea, which it resembles in character.

[1] "Proc. Berlin Roy. Acad.," 1882.

3. *Eocene and Cretaceous Geology.*

Eocene beds occur on both sides of the Nile, from Cairo to El Kab, near Edfou, and have been very well described by several geologists, more especially by Fraas and Zittel. They are largely or dominantly calcareous, and rich in *Nummulites* in their middle portion. According to Zittel they attain to the thickness of 760 mètres, of which nearly one-third, or 600 feet in vertical thickness, can be seen in the single section of the Mokattam hill, near Cairo.[1] In this section, the upper or middle portions are those exposed. The lower part is to be seen in the vicinity of Thebes.



Fig. 5.—Lower Eocene Limestone and Softer Beds near Thebes.

Though these beds are nearly horizontal, or with only a slight northerly dip, they seem to be traversed by lines of fault, running approximately north and south, and east and west, which sometimes change the relative positions of the beds. On the Arabian or Eastern side of the river, the beds have probably been supported by the subterranean extension of the old crystalline rocks of the hills between the Nile and

[1] See Prof. J. Milne, "Geol. Mag." 1874, pp. 353–362; and review of Zittel's recent work, "Geol. Mag." 1884, pp. 172–179.

the Red Sea, and are consequently more firm and regular. On the Lybian side they are more disturbed, and probably somewhat thrown down and fractured. This is well seen at Cairo and Gizeh on the opposite sides of the river. At the former place the beds seem undisturbed. At the latter they are much shifted by faults, so that in places the newer members of the series are brought down to the level of the middle portions. To the north, where the crystalline rocks terminate, the east-and-west fractures become more pronounced. A very important one seems to pass through the Wady Dugla, behind the Mokattam hill, extending thence eastward towards the Red Sea. The north-and-south fractures have no doubt exercised an important influence in determining the position of the river valley; and their comparative absence on the eastern side has tended to give greater continuity and elevation to the cliffs on that side as far up as Thebes.

Schweinfurth's map and section of the Mokattam hill may be summarized as follows, in descending order,[1]—

Upper Eocene.

(*a*) Brown arenaceous sandstone at summit of the ridge 640 feet above the sea. Characteristic fossil, *Echinolampas Crameri;* contains also *Nummulites Beaumontii.*

(*b*) Ochraceous Marl, with clay ironstone, and abounding in fossils. The upper beds contain many bivalves, especially a Lucina. In the middle beds *Plicatula polymorpha* and *Ostrea Clotbeyi* abound, and the latter, with species of Turritella and Callianassa, is still abundant in the lower beds. Some small Nummulites also occur.

These Upper Eocene beds have an aggregate thickness of nearly 200 feet.

Lower Eocene.

(*c*) This, which attains a thickness of about 300 to 400 feet, is essentially a limestone formation, usually white, and rich in Nummulites and in some beds composed of small Foraminifera. One remarkable band is made up of Bryozoa. Among its characteristic fossils are the Cairo crab, *Lobocarcinus Paulo-wurtemburgensis*, the great *Cerithium giganteum*, and a variety of Echinoids belonging to several genera. This is the great limestone of the Nile valley, and constitutes the greater part of its boundary cliffs, the lowest Eocene beds appearing from under it far up the river in the vicinity of Thebes.

[1] "Proc. German Geol. Soc.," 1883.

At Thebes, the upper beds correspond with the middle and lower parts of the Mokattam series, but are underlaid first by Lower Eocene marls and clays and next by Cretaceous beds (Nos. 6 and 7 *infra*). The succession at and about Thebes may be stated as follows, in descending order :[1]—

(1.) Limestone with flint—*Ostreæ flabellata*, small Nummulites (*N. Thebaica*.

(2.) Marls and Limestones—*Schizaster*, *Amphidotus*, *Lucina squamula*, *Crassatella tumida*, *Nummulites*.

(3.) White Limestones with flints, *Lucina inflata*, *Cardita*, *Venus*, *Turritella*, etc.

(4.) Chalky White Limestone, foraminiferal. In this are the tombs of the kings.

(5.) Grey Marls, ostracoids, foraminifera, and shells of Lower Eocene types.

(6.) Chalky Cretaceous Limestone and plant-bearing series, clays and sands of Edfou (Upper Cretaceous).

(7.) Nubian Sandstone.



FIG. 6.—CRETACEOUS BEDS ABOVE SILSILIS.

In the beds at Edfou (No. 6 above), borings made for coal have ascertained the existence in clays and sandy beds of carbonized wood, striated leaves, and stems resembling those of reeds. The Cretaceous formation does not, however, attain to so great a development in Egypt as in Syria; and this, I think, is an important point with reference to the attempts which have been made to correlate the rocks of the two regions. We shall best understand their true relations by studying a section geographically intermediate, which we may find on the shores of the Red Sea, sixty miles to the eastward of the great Mokattam section, near Cairo.

Tracing the Mokattam range to the eastward, in Jebel Attaka on the Red Sea, it rises to a considerably greater elevation, and while its upper part consists of Eocene limestone, with

[1] Delamare, "Comptes Rendus," 1868.

Nummulites[1] and other characteristic fossils, its lower part is Cretaceous, and holds *Hippurites* and *Ostrea larva*. The Cretaceous here consists of hard limestones, not, in so far as I know, found in the Nile valley, but comparable with those seen farther east and north in Judea and the Lebanon, while the Eocene beds appear to be less highly developed and less purely calcareous than on the Nile. The structure of Jebel Attaka, in short, appears to afford a clue to the apparent anomalies of the distribution of the Cretaceous and Eocene in Egypt, Arabia, and Syria. It would seem that while in all these countries the Cretaceous and Eocene are conformable, and closely associated with each other, they have from the first

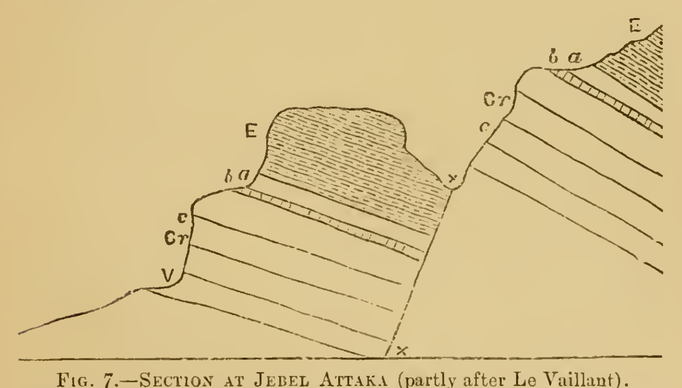


Fig. 7.—Section at Jebel Attaka (partly after Le Vaillant).
(E) Eocene: (Cr.) Cretaceous, including (*a*) White Chalky Limestone; (*b*) Red and Greenish Marl; (*c*) Hard Limestone and Dolomite with *Hippurites*, *Ostreæ*, etc.; (V) Position of Quarry; (× ×) Supposed Line of Fault.

been unequally deposited. The calcareous members of the Cretaceous, slenderly developed in Egypt, increase in volume on the Red Sea, and attain their maximum in Syria, while those of the Eocene show their greatest thickness in Egypt, and become depauperated farther to the east. This is at least what appears to me the obvious explanation of the difficulties

[1] It has been stated that *Nummulites* do not occur here; but I was so fortunate as to find specimens of coarse limestone full of them.

which have occurred in correlating the Cretaceous and Cocene beds of these countries.

M. Le Vaillant[1] has given a detailed section of the beds of Jebel Attaka, of which the following is asummary, in descending order:—

EOCENE	Dolomitic Limestone—*Potamides* and *Cerithium* (Holds also *Nummulites* and various Eocene bivalves)	150	mètres.
CRETACEOUS	White Chalk	50	,,
	Red Marly and Gypseous Band	7	,,
	Alternations of Chalk and Dolomite	109	,,
	White Chalk	2	,,
	Dolomite — 2 species of *Hippurites*, *Ostrea larva*, *Janira sexangularis*, *Exogyra*	53	,,
	Total..................	371	

Zittel gives the following section of the Cretaceous of Lybia, in descending order:—

(1.) White Chalk, foraminiferal, 20 to 50 mètres.
(2.) Grey Laminated Clays, sometimes bituminous and gypseous, 30 to 80 mètres.
(3.) Limestone, Clay, Rock Salt and Gypsum, *Exogyra*, fossil wood, fish, teeth, etc., 150 mètres.
(4.) Nubian Sandstone. (The Palestine sections will be found below.)

It would appear that throughout the Eastern Mediterranean there is no stratigraphical break between the Cretaceous and Eocene, while two periods of partial elevation and shallow-water conditions are represented by the lignitiferous zone of the Cretaceous, which occurs in the Lebanon as well as in Egypt, and by the argillaceous and gypseous beds near the top of the Eocene in Egypt. The periods of greatest limestone deposition would seem to have been in the Middle and Upper Cretaceous in Syria, and in the Middle Eocene in Egypt. These facts serve to illustrate the importance of a detailed study of rocks and fossils in each locality, before instituting comparisons of horizons. The difficulties hitherto experienced in this have also arisen, in part at least, from a too close adherence to European distinctions, which may not be strictly applicable in the East, though the general order of succession of fossils is no doubt similar in both.

[1] "Bulletin Geol. Soc. of France."

The question of the age of the Nubian sandstones is at present somewhat difficult, and has recently been ably discussed by Hudleston[1] and by Hull. On the Nile it succeeds at Silsilis the Cretaceous beds above referred to, in descending order, and apparently conformably, and forms an east-and-west ridge, through which the river passes in a narrow gorge. In this outcrop are the celebrated quarries from which so much of the stone of the Egyptian temples was derived. The Silsilis exposure is, however, limited in breadth, and south of it beds similar to those on the north recur, leading to the supposition that there is here an east-and-west fault or roll of the strata, repeating the beds, or else that there are two distinct sandstones. I had not opportunity to work out this point satisfactorily, but believe that there is little reason to doubt the existence of a downthrow fault, repeating the Cretaceous beds, at the south of the Silsilis ridge. A little below Kom Ombos the sandstone reappears, and continues all the way to Assouan. At one point in this section two distinct beds are seen, the upper a ferruginous irregular sandstone and the under grey and laminated. They appear, as seen from the river, to be unconformable, but this may be merely false bedding. At another place the sandstone is seen to be shallow, a mass of dark-coloured crystalline rock appearing below it. At Assouan, however, where it reposes on the Laurentian and Granitic rocks, it appears in some places to be at least 100 feet in thickness.

The conformable manner in which the Nubian sandstone underlies the Cretaceous, and the occurrence of a few Cretaceous fossils in its upper part, have induced Zittel and others to consider the whole of it as merely a lower member of that formation. Of this, however, there is no distinct evidence in regard to its lower part; and the only determinable fossil hitherto obtained in this part of the formation—a species of *Dadoxylon*

[1] As Hudleston has remarked, Bauerman's section of the Tih escarpment exhibits a lower sandstone, in connection with which the fossils regarded as Carboniferous occur; while higher in the series there are other sandstones associated with calcareous beds holding undoubted Cretaceous fossils. "Geology of Palestine, Proc. Geol. Assoc.," vol. viii. See also Hull's Report.

(*D. Ægyptiacum* of Unger) — has a Palæozoic rather than Mesozoic aspect. Specimens of this wood have been obtained at Assouan and Kom Ombos; and Newbold mentions[1] the discovery of coniferous wood at Ipsambul, in Nubia, which must also have been in this formation. On the other hand, *Nicolia* is also stated to have been found in it; but this I suspect to be an error. In any case the Nubian sandstone is the oldest formation on the Nile next to the old crystalline rocks, to which it clings all along their margin, and from whose waste it is obviously derived. It may not improbably be a Palæozoic deposit, the upper part of which has been *remanié* and mixed with the early Cretaceous beds. This would imply a remarkably undisturbed condition of the Egyptian area in the later Palæozoic and earlier Mesozoic periods. There is, however, a similar case in the Triassic red sandstones of Prince Edward Island in the Gulf of St. Lawrence, which rest so conformably and continuously on the upper red sandstones of the Permo-Carboniferous from which they are derived, that it is almost impossible to separate them.[2]

If we appeal in this case to the so-called Nubian sandstones of the Sinaitic peninsula, we find that there Bauerman and others have found animal fossils of Carboniferous species as well as *Sigillaria* and *Lepidodendron*.[3] Of these I have seen only the specimen of *L. Mosaicum* in the collection of the Geological Society, which is in a hard grey sandstone, and has a decidedly carboniferous aspect. The sandstones of Wady-Nasb, which have afforded these fossils, are connected by a continuous line of outcrop with those of the east side of the Dead Sea, which underlie the Cretaceous of that region, just as the Nubian sandstone does in Egypt. It will be seen in the sequel that Hull has separated the lower sandstone under the name of Desert Sandstone; and Schweinfurth has recently found palæozoic fossils in the Nubian sandstone of the Red Sea border. The species are not named in his memoir, but

1 "Quart. Journ. Geol. Soc.," 1848, vol. iv. pp. 349–357.
2 Acadian Geology.
3 Tate, "Quart. Journ. Geol. Soc." 1871, vol. xxvii., p. 404; Hudleston, "Address to Geologists' Assoc.," vol. viii. 1883, pp. 1–53.

Beyrich seems inclined to refer these to the Devonian; they may, however, be Lower Carboniferous.[1]

On the other hand, I have studied certain sandstones associated with the lignitiferous zone of the Lebanon, and which have been correlated with the Nubian sandstones; but these are stratigraphically included in the Cretaceous limestones, and contain *Ostrea succini* and other Cretaceous fossils. They hold also fossil coniferous wood, which I have not yet examined microscopically, but it has a decidedly Mesozoic aspect. These Lebanon beds I would correlate with the similar beds above referred to, near Edfou in Egypt, rather than with the Nubian sandstone.

On the whole, therefore, it would seem that we have in Upper Egypt and in Sinai an upper palæozoic sandstone, supporting a not dissimilar sandstone of Lower Cretaceous age; and that the deposits which have been known by that name in the Lebanon are altogether distinct, and belong to a Cretaceous lignitiferous zone of Upper or Middle Cretaceous age. We shall further discuss this question under the geology of Palestine. I may add here that in Egypt there are sandy beds containing Cretaceous fossils, or alternating with fossiliferous limestones and marls above the horizon of the Nubian sandstone properly so called.[2]

4. *The Crystalline Rocks of Upper Egypt.*

A sudden and great change takes place in the geology of the Nile valley in approaching the First Cataract, where we pass from the unaltered and nearly flat Nubian sandstones to rocks highly crystalline, greatly disturbed, and penetrated with multitudes of igneous veins.

The gneisses and schists associated with granite and diorite at Assouan and its vicinity, though they have attracted the attention of the most unscientific travellers, have apparently as yet been little studied in detail. They have, however, been described by Lieut. Newbold in the "Journal of the Geological Society of London," vol. iii., and in the same Journal, vol. xxiii.,

[1] "*Bulletin de L'Institut Egyptien*," 1886.
[2] Ibid.

Mr. Hawkshaw has given a good map of their distribution, and has noticed most of the kinds of rock, though without inquiry as to their precise age or general mode of arrangement. Lartet has given in his "Geology of Palestine," a summary of the observations of Russegger, Rivière and Figari Bey on the crystalline rocks of the Nile; and the allied rocks of the Sinaitic peninsula have been described by him, by Bauerman, and by Holland, and more recently by Hull. All these authors have noted, more or less distinctly, a series of gneisses and micaceous and hornblendic schists, associated with intrusive granites and diorites, as the oldest rocks of these districts, and succeeding these in geological age, certain slates and

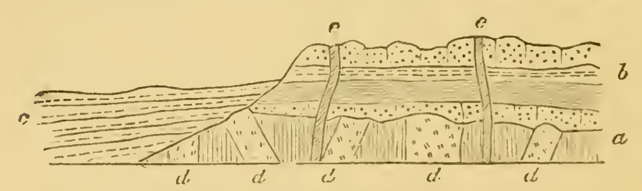


Fig. 8.—Crystalline Rocks and Nubian Sandstone at the Island of Biggeh (Ideal Section).

(*a*) Older Crystalline Series (Laurentian). (*b*) Second Crystalline Series. (*c*) Nubian Sandstone. (*d*) Dykes of Granite and Diorite. (*e*) Dykes of Felsite and Basalt.

associated rocks, with porphyry and basanite in beds and veins.

The town of Assouan is situated at the northern end of a ridge of crystalline rock, which runs about south ten degrees west, along the side of the river towards the Cataract. South of the town a cutting has been made across this ridge for railway purposes, which affords a good opportunity for studying the structure of the formation. The following section is exposed in this cutting, beginning at the western end, the beds being nearly vertical, and with strike E. ten degrees north:—

Micaceous and hornblendic schists, with many red granite veins, one of them holding nests of broad-leaved magnesian mica	66 paces.
Dyke of coarse-grained hornblendic granite, with reddish orthoclase	6 ,,

Schists, as before, with large granite veins	53	paces.
Gneiss, with granite veins	7	,,
Schist, with much black mica	23	,,
Coarse orthoclase gneiss, with beds of schist . . .	20	,,
Micaceous and horblendic schists	7	,,
Gneiss and schist	3	,,
Schists and gneiss	7	,,
Orthoclase gneiss	7	,,
Hornblendic and micaceous schist, with veins of coarse granite	41	,,
The same, with veins of red felspar	37	,,
Micaceous and hornblendic schists, much weathered at the surface	34	,,
Total . . .	311	paces.

Eastward of the cutting the ground becomes flat, and does not afford a continuous section; but the decayed edges of micaceous and hornblendic schists, and thin-bedded gneisses appear at intervals for about 800 yards, after which they are overlain by the base of the Nubian sandstone, which farther east rises into the table-land of the Arabian desert.[1] The base of the sandstone at this place shows a thin bed of conglomerate, and upon this some soft calcareous layers, above which is the ordinary grey sandstone.

The above section represents at least two thousand feet in thickness of crystalline schists and gneiss, with granite veins. To the latter category belongs the huge dyke of granite at the north end of the ridge, in which are the principal Egyptian quarries, though there are other ancient quarries in granite, diorite, and sandstone in several places in this vicinity. One of the diorites has a porphyritic character, caused by crystalline patches of white felspar, and this stone appears as a material of statues and other objects in all parts of Egypt. Two sphinxes from Pithom, now in the square of Ismalia, are of this material. There are also dykes of a black basaltic rock. No crystalline limestones were observed, but from the manner in which the surfaces of the gneiss and schist are disintegrated, it may be inferred that the outcrop of limestones, if present, would be deeply eroded and concealed. It would seem from this disintegration that the climate here has

[1] In approaching the sandstone, the strike of the schists changes to about N. 7·0 degrees E.

not always been so rainless as at present. Possibly, also, some of the now crumbling rocks may have resembled the coarser earthy limestones or calcareous gneisses of the Laurentian of Canada, which, when weathered, present a very similar appearance.

Many of the granite dykes extend in the plane of the stratification, and for this reason it is not always easy, without careful observation, to distinguish them from the beds of gneiss. They are, however, generally coarser, and not laminated, and can be observed to send off branches into the adjoining beds. The mica present in the schists seems to be in all cases biotite rather than muscovite. The distinctly bedded character of the schistose rocks at Assouan is quite as manifest as in the case of the Laurentian of Canada; and the fact that the schistose structure is not an effect of pressure or crushing is manifest from the want of such structure in the true dykes.

At the Island of Biggeh, above the Cataract, and near to Philæ, there appears to be a second crystalline formation, resting in a horizontal position on the older gneiss and schists, and itself overlaid by the Nubian sandstone. The precise arrangement of these rocks could not be seen so clearly as was desirable, owing to the *débris* which covered the sides of the cliffs; but on the island of Biggeh their order appeared to be as follows, in descending series:—

(1.) Coarse dark-coloured porphyritic rock with large crystals of deep red felspar, darker in colour and more opaque than that of the lower series. This rock breaks into cuboidal masses, giving the cliffs composed of it a remarkable castellated appearance.
(2.) Fine reddish gneissose rock.
(3.) Black fine-grained coarsely laminated beds.
(4.) Coarse porphyritic rock (porphyritic granite), resembling No. 1.
Below this are the schists of the lower series, in a position nearly vertical.

The whole thickness of this upper series appeared to be about a hundred feet. On the mainland east of Biggeh it forms a high ridge stretching to the eastward. These rocks are certainly not ordinary aqueous deposits, and would rather seem to be a series of bedded igneous rocks, ejected over the edges of the older series, and subsequent to its disturbance

and metamorphism, but before the deposition of the Nubian sandstone. Whatever the origin of these rocks, they appear to overlie unconformably the lower series, and they did not appear to be penetrated by the great granite veins. They are, however, traversed by veins of red felsite and of a black igneous rock, having the appearance of basalt.

Rocks of the character above described might of course admit of different interpretations as to their relations and origin; but as seen on the ground, they undoubtedly have the aspect of an overlying, unconformable stratified formation, and their crystalline character must be due to the conditions of their formation, and not to any subsequent mechanical action. They are, therefore, to be regarded as igneous or aqueo-igneous deposits.

Above the Cataract the river passes through a gap in the rocks above described, between the island of Biggeh and the eastern shore, and runs over the older series, the granitic dykes of which project in prominent masses above the softer schists, as may be seen in the rocks of Konosso, and the eminence on the west end of Philæ. In cutting back its channel, the Nile must originally have formed its First Cataract at the ridge of Silsilis, about forty miles below Assouan, and its waters were then dammed up so as to flood much of the river valley between Silsilis and the present site of the First Cataract. At this time the Nile probably flowed along the old channel east of Assouan; but so soon as the channel was cut back through the Silsilis ridges, it would rapidly extend southward through the softer beds to Assouan, and on reaching this place, the river would begin to remove the Nubian sandstone capping the crystalline rocks at the site of the present cataract. This process would seem to have disclosed an ancient break or soft portion in the underlying formation, enabling the present channel to be cut, and this has been done mainly by removal of the sandstone and of loose fragments of the second crystalline formation above referred to.

In so far as the locality at the First Cataract is concerned, we have no precise measure of age for the crystalline rocks. There is reason to believe that in the range of similar for-

mations extending northwards between the Nile and the Red Sea, beds occur of ages intermediate between those of the rocks of the Cataract and the Nubian sandstone; but the precise ages of these intermediate rocks are as yet uncertain. In these circumstances mineral character becomes our only guide. But this is by no means uncertain in its testimony. The schists and gneisses of the older Assouan series are identical in mineral character with those of the Grenville series of the Canadian Laurentian; and they have already been compared by Drs. Liebisch and Hochstetter with the rocks of the same age in Scandinavia.[1] In like manner, the second or overlying series has two points of similarity with the felsitic series found in America to occur at the base of the Huronian, which has been named by Hicks the Arvonian series, and to which the Swedish geologists have given the name halleflinte. I think, therefore, we may be justified in regarding these old crystalline rocks as African representatives of the Laurentian, and one of the succeeding crystalline formations; and of course the same conclusion would apply to the wide extent of similar rocks in this part of Africa, and to the southward as far as the Cape Colony, and which recur in the peninsula of Sinai. In any case, it is very interesting to find the oldest rocks of Africa presenting the same mineral characters with those of Europe and America.

Assuming the lower Assouan series to be Middle Laurentian, the next rocks to be expected in ascending order would be the Upper Laurentian and the Huronian. To the former the second Biggeh series bears no resemblance; but there are known to be in the Arabian chain, and probably associated with the equivalents of the Assouan rocks, Norian rocks of the character of anorthosite gneiss, a rock which was used by the ancient Egyptians for statuary, but is generally called diorite by antiquaries, though it differs very much from the true diorites of the country.

Dr. Schweinfurth has sent me, from the districts of the

[1] "Geological Society of Germany, Jahrbuch," 1877. I have placed a suite of specimens in the hands of Prof. Bonney, F.R.S., whose notes on them will be found below (Section II.).

Arabian chain north of Assouan, a rock similar to the more compact variety of the dark Biggeh rock, which he states forms ridges parallel to the main chain of crystalline rocks. Newbold refers to greenish and chocolate-coloured schists and quartzite, as bordering the older schists and granites, and Lartet notices talcose and chloritic slates with granulite in a similar relation, crowned by the celebrated green conglomerate and breccia of Kosseir and Gebel Doukhan. Further, Russegger connects the red porphyry and petrosilex porphyry with large felspar crystals of Gebel Doukhan with this second series, and Lartet has described the quartziferous porphyry of Mount Hor as lapping around the granite nucleus of that mountain.

It would thus appear that the Laurentian gneisses and schists of Upper Egypt and its eastern mountain chain are succeeded by formations which may be held to represent the Upper Laurentian and Huronian series at least; and I would regard the Biggeh formation, or second Assouan series, as consisting mainly of bedded volcanic material, representing some portion of the Huronian, a formation which would seem to have been more largely developed, or to be better preserved in some parts of the Arabian chain to the north and east where it is also overlain by slaty rocks, and by the green conglomerate which either constitutes an Upper Huronian series, or may represent the Animiké and Kewenian formations of America. There would seem in this district, as in Palestine, to be a great geological hiatus between these old rocks and the Nubian sandstones.

The rocks quarried by the ancient Egyptians at Assouan or Syene, for buildings, obelisks, and statues, seem to have been principally the red granite and different varieties of dioritic rocks; and the latter they obtained not so much from regular quarries as from projecting masses, the ruins of dykes exposed by denudation, and which had the double advantage of being free from cover, and of consisting of material of proved durability. Illustrations of their working such exposed masses may be seen in several places near Assouan. The thick granite veins often contain, as is not unusual in such masses,

detached fragments of the schists and gneisses which have been caught up in them; and these are not infrequently to be seen in the sculptured Egyptian blocks. The gneissose rocks themselves occur but rarely as the material of sculptures.

Having noticed at the Boulak Museum a statue of Kephren, the builder of the second pyramid, in a stone which seemed to be a gneissose anorthosite, I had expected to find some indication of the Norian formation in Upper Egypt. In this I was disappointed, but was afterwards informed by Brugsch Bey that he had reason to believe that the stone in question was obtained from the eastern hills between the Nile valley and Kosseir on the Red Sea. It is not unlikely, therefore, that in these hills some representative will be found of the Norian or Labradorian series to fill up a portion of the gap existing between the two crystalline series at Assouan.

5. *General Remarks and Conclusions.*

We are now in a position to indicate the succession of geological events in Egypt, and to compare them with those of the neighbouring regions.

(1.) The original foundation of this part of Northern Africa was laid in those movements of the Old Laurentian beds which in so many regions gave the first form and direction to the continental masses. It would also seem that in Egypt, as elsewhere, the folding and crumpling of the Laurentian was accompanied and succeeded by the emission, from the interior of the crust, of masses, veins, and beds of igneous and aqueo-igneous material, penetrating and over-lapping the upturned Laurentian strata, and accompanied with the deposition of the material of a newer crystalline series. I have described these phenomena as seen at the island of Biggeh, near Philæ; and it seems probable, from the descriptions of Lartet and others, that some of the porphyritic beds seen on the flanks of Mount Hor, and elsewhere in Arabia, are of the same character with those of Biggeh, and may be regarded as representing the Arvonian or the Huronian of more northern countries. As stated above, the anorthosite gneiss, which is the material of the statue of Kephren in the Boulak Museum,

may indicate a representative of the Norian series in the crystalline mountains eastward of the Nile.

(2.) The argillites and chloritic and other schists used by the Egyptians in the manufacture of many minor sculptures, and said to be associated with the celebrated green breccia of Cosseir,[1] are probably of somewhat later age, since the breccia contains fragments of several of the older rocks. They are certainly, however, older than the Carboniferous, and not improbably pre-Cambrian. They have participated to some extent in the disturbances of the older formations.

(3.) In the later Palæozoic period the crystalline rocks seem to have constituted insular tracts in a shallow sea, in which sandstone was being deposited. It seems definitely ascertained that the lower sandstones and limestone of Wâdy Nasb and other places in the Sinaitic region, which Hull now proposes to call the "Desert Sandstone," are of Carboniferous age.

The *Lepidodendron Mosaicum* of Salter, and other plants subsequently found, are certainly Carboniferous forms; and the marine fossils, the first of which were found by Bauerman in the associated limestone, are now recognised as of the same age. In Egypt, fossils of this age have now been found[2] in the Nubian sandstone; and there are indications, as above stated, on the Nile, that this is divisible into two members, the upper of which may be Lower Cretaceous, while the lower may be Palæozoic. In this case, as all the sandstones are products of the decay of the crystalline rocks, and are undisturbed, they may possibly represent a shallow sea continuing throughout the Carboniferous and Early Mesozoic ages, and receiving the coarser *débris* washed down from the older formations. As already stated, the sandstones of the lignitiferous zone of the Lebanon are probably somewhat higher in the Cretaceous series than the Upper Nubian sandstone of Egypt and Southern Palestine, and are probably Cenomanian. Possibly the beds with vegetable remains which have been reached by boring near Edfou may be their representatives.

[1] Lartet.

[2] Schweinfurth, referred to above. The locality is Wady Arabah, on the Red Sea coast.

(4.) The middle and later part of the Cretaceous was in this region a time of submergence. But in the Nile valley, and generally in the vicinity of the older rocks, the amount and duration of the submergence were less than farther to the north and east, so that the Cretaceous limestones of Palestine are of much greater volume than those of Egypt. It is to be observed, however, that if the lignitiferous sandstone of the Lebanon is correctly referred by Fraas to the upper part of the Cenomanian, then a period of shallow-water and land conditions must have recurred in that region, and interrupted the marine conditions.

(5.) The Cretaceous depression continued throughout the Eocene period, and the great thickness of the limestones of this age in Egypt, and the moderate depths which they indicate, would seem to testify to a slow and long-continued depression, which does not seem to have prevailed to the same extent in Syria. Hence the Eocene deposits of the latter country are much less important.

(6.) The first important elevation seems to have occurred at the close of the Eocene, so that the beds of that age furnished the soils on which the *Nicoliæ*, pines and palms, of the Gebel Ahmar sandstones flourished; and the areas of marine Miocene are very limited in Egypt, and mostly limited to the coast in Syria, indicating that the region had already assumed a continental character.

(7.) The Pliocene age was probably still more continental; and it is possible that in this age the Nile emptied into a great enclosed saline basin, of which the deposits now constituting the higher portion of the Isthmus of Suez may be a monument, though it is also possible that they may belong in whole or in part to the second continental period of the post-glacial age. However this may be, it seems certain that Egypt shared in the great submergence of the Pleistocene and in the subsequent elevation which immediately preceded the Modern age.

(8.) The historical period has been characterized by the deposition of much fluviatile sediment, especially in the Delta, and probably, by a slight depression of the Mediterranean coast, accompanied by a corresponding slight elevation between

Cairo and the Gulf of Suez. From the close of the Pleistocene period, however, the central part of the Isthmus of Suez would appear to have been land, since it consists of fluviatile and lacustrine deposits, formed by the Pliocene or post-glacial Nile, and is uncovered by the modern beds which lie on either side, and contain respectively the shells of the Red Sea and of the Mediterranean.

(9.) The remains of man discovered in the Nile Valley are all superficial and modern, unless we except the supposed implements found by General Pitt-Rivers in the old indurated gravels near Thebes, which are probably of Pleistocene age. I have, however, elsewhere shown that there is no certainty as to the human origin of the flakes found in these beds.[1] Of the mode of occurrence and relations of the flint implements found on the surface in various parts of the valley of the Nile, a very good account is given by Mr. Jukes-Browne, in his papers in the Cambridge Antiquarian Society's communications, and in the Journal of the Anthropological Institute. The same conclusions apply to the flint implements found on the surface in Judea and at Beyrout, though there are remains of greater antiquity in the older cave-breccias of the Lebanon.

(10.) It thus appears that the position of the valley of the Nile was primarily determined by that of the ridges of old crystalline rocks which caused the flow of drainage to the north, and prevented direct communication with the depression of the Red Sea. It was also influenced by the fractures and faults above referred to, as occurring in the elevation of the Eocene beds, and which produced lines of weakness along the course of the present valley. Much of the actual cutting of the valley must have been effected by the sea in times of Pleistocene submergence, and it must have been at this time that the extensive removal of the softer parts of the Miocene sandstone, evidenced by the loose trees of the petrified forests, occurred. At this time also, many inland cliffs and wadys must have been cut, and beds of gravel deposited. To this period we may also refer the scattering of boulders from the

[1] "Transactions, Victoria Inst.," 1884.

eastern crystalline mountains over the Lybian desert, as seen for example at Denderah. This transport of boulders would indeed seem to imply the action of floating ice in some part of the Pleistocene period, though it is possible they may have been pushed by the waves along coast-lines which have since disappeared. Lastly, from the first elevation of the Eocene beds, the river itself has been extensively modifying its bed, both by erosion and deposition. It is difficult in all cases to separate the effects of the river erosion and that of its lateral torrents from those of the previous submergence. It is certain, however, that the river action is capable of undermining and gradually cutting back cliffs, and that the present rainfall, small though it is, is yet delivered in such heavy showers as to produce violent and destructive floods. It is probable also that there may have been a period of greater rainfall at the close of the Pleistocene, of which there seems to be evidence in the deposits surrounding the Dead Sea and in the older alluvia of the Nile itself. The cutting back of the cataracts of the Nile has been already referred to. A curious memorial of this exists in the diverted channel of the river at Assouan, along which the railway at that place runs. According to the measurements of Mr. Hawkshaw, it is seven miles and a half in length; and 100 feet above the present level of the low Nile above the cataract. Thus it belongs to a time when a large amount of cutting remained to be done, before the river attained to its present state. In this channel are old banks of Nile mud, which may be seen behind Assouan and also near Philæ, and have been described by Dr. Leith Adams.

It thus appears that the Nile, like most other great rivers, has been only in part the excavator of its bed, and that it has been indebted to preparations made for it in very ancient times, though mainly to the changes connected with and consequent on the great elevations at the close of the Eocene Tertiary, and the marine erosions taking place in still later submergence and re-elevation. In connection with this, it is interesting to note the recency of the present alluvial plain, and the probability that in the first or second Continental

period, or in both, the Nile discharged itself to the eastward into the Arabian desert at the head of the Red Sea.

II. NOTES ON EGYPTIAN ROCKS.

1. NOTES ON ROCKS FROM ASSOUAN.[1]

(*By Prof. T. G. Bonney, D.Sc., LL.D., F.R.S.*)

OLDER GNEISSIC SERIES, ASSOUAN.

(3.)[2] A moderately fine-grained holocrystalline pink and white rock, speckled with black, of slightly gneissic aspect.

Microsc.—Quartz, felspar, orthoclase with some microcline and plagioclase, biotite, occasionally showing signs of alteration to the usual green mineral, a little apatite, and a small yellowish mineral, probably sphene. The rather irregular outline of the felspars and the granular aggregation of the quartz resembles in some respects the structure of a gneiss rather than a granite; but it is very probable that this structure is the result of some pressure and crushing after the consolidation of the rock, of which the hand specimen gives indication: in all other respects one would not hesitate to call it a granite.

(4.) A rather fine-grained holocrystalline rock, speckled pinkish and dark coloured.

Microsc.—Quartz, felspar (orthoclase, microcline, and plagioclase), with a considerable amount of brown mica, a little apatite and epidote or sphene, with a very little iron peroxide. It is extremely difficult to say whether this be a gneiss or a granite crystallizing after the vein granite type (granulite of Fouqué and Lévy), modified slightly by subsequent pressure. After all, perhaps, some of the very coarse ancient gneisses may be only crushed and recemented granites.

(5.) A rather fine-grained holocrystalline rock, speckled pinkish and dull green; general tint inclining to dark.

Microsc.—The remarks on (4) will apply here, except that

[1] From the *Geological Magazine*, March, 1886.
[2] The numbers are those on the specimens examined.

there is rather more biotite and apatite. The structure also is more gneissic; but it is very doubtful from indications given by the slide whether we can trust this, and whether the rock may not originally have been a granite.

(7.) A dark crystalline hornblendic rock, with a slightly fissile structure.

Microsc.—Holocrystalline; hornblende and felspar (chiefly plagioclase), a little epidote (probably) and magnetite, a flake or two of biotite, and a very little apatite. Very difficult to decide upon the origin of this rock. I incline to think it igneous, and a diorite.

(8.) A rather dark grey and pink, somewhat finely crystalline rock, with fairly distinct foliation.

Microsc.—Quartz, felspar,—orthoclase, a little microcline, plagioclase (? albite),—biotite, with a little iron peroxide, and a very little apatite. The structure much resembles that of one of the old Laurentian gneisses, which is also in accordance with the macroscopic aspect of the rock.

(11.) A gneiss distinctly streaked with pinkish felspathic and dark hornblendic or micaceous bands; the former, with occasional rounded felspars, have an aspect suggestive of much crushing. This appearance is fully confirmed by microscopic examination. The rock has evidently been once either a hornblendic granite or a granitoid gneiss, and its present structure is due to great crushing, so that in parts it is like an ordinary fragmental arkose. The dark mineral appears to be chiefly hornblende, though much biotite is also present; its crystalline grains are mostly small. Orthoclase, microcline, and plagioclase were probably among the felspars of the original rock. There is some apatite, also sphene (?), ilmenite (?), and a crystal of a dark brown mineral unknown to me.

(12.) A very dark distinctly foliated schist, composed chiefly of mica and a decomposed (?) felspathic mineral; some of the mica has a brassy lustre. The attempt to obtain a slice of this rock has been a failure, as it is so friable.

(13.) A hard quartzose schist, with not much mica, and little signs of foliation.

Microsc.—The principal constituents are quartz, felspars of

more than one species, and brown mica. The rock appears to have been squeezed, but not crushed. It has the aspect of a true gneiss, one of the fine-grained kinds that rather resemble quartzites.

(14.) Rather like (12), but with a felspathic vein.

Microsc. — Dominant minerals, plagioclase, biotite, hornblende, some quartz, but variable in distribution. Parts of the slide might thus be called hornblendic gneiss, the rest rather hornblendic mica-schist. The rock certainly must now be called one of the above names, but there are peculiarities in its structure which prevent me from making any confident statement as to its origin.

(15.) A rather "slaty" fine-grained gneiss, related to (13), but more fissile.

Microsc.—It has a general similarity to (13), but contains more mica. Also it has yielded more to pressure.

I may add that among the specimens from this series are several rather fine-grained dark mica-schists or very micaceous gneisses, varying between (12) and (15), which are so obviously representatives of the "metamorphic" group of rocks, that I have thought it needless to examine them under the microscope. They have a general resemblance to schists not unfrequent in the upper parts of the Hebridean series of Scotland, and may be compared with some of those which occur (for example) in the neighbourhood of Gairloch (Ross).

Intrusive Rocks (Dykes, etc.) in Series.

(1.) A holocrystalline rock, mottled dark green (almost black) and light yellowish, with porphyritic felspar crystals of latter colour, sometimes about one inch long.

Microsc.—Consists of quartz, felspar—orthoclase, microcline, plagioclase (albite ?)—hornblende, biotite; with a little magnetite, a good deal of apatite in well-defined hexagonal prisms, and a little of a granular yellowish mineral, probably sphene. Thus the rock is a hornblendic-granite; it is not very rich in quartz.

(2.) Coarsely crystalline rock, with large pinkish-red felspar crystals, quartz, some whitish felspar and black mica. One

of the granites commonly used in Egyptian monuments, and, as is often the case with these, it has a gneissoid aspect.

Microsc.—Holocrystalline; quartz felspar, chiefly microcline, with some plagioclase, brown mica, with a little hornblende, a little magnetite, some apatite, and a yellowish mineral; sphene, or perhaps epidote. The irregular outline of the felspar and the aggregated granules of quartz resemble a gneiss, but this may be due to subsequent crushing.

(6.) A holocrystalline rock, moderately coarse, speckled with light greyish colour and black (mica).

Microsc.—Quartz, felspar (orthoclase, microcline, and plagioclase), a good deal of biotite and hornblende, rather rich in apatite, some magnetite, some sphene (one crystal rather large), also several long colourless needles, ? sillimanite; a hornblendic granite, rather poor in quartz.

UPPER SERIES AT BIGGEH (ASSOUAN).

(9.) A dark rather compact rock, with but slight indication of a schistose structure.

Microsc.—Holocrystalline; quartz, felspar (apparently both orthoclase and plagioclase, but not very well characterized), biotite and hornblende, with a little magnetite, apatite, and sphene. It resembles a hornblende schist, but slightly foliated, rather than an igneous rock.

(10.) A dark rather compact massive rock with rectangular jointing.

Microsc.—Holocrystalline, but not coarse, composed of biotite, rather dark-coloured, but partly altered into a greenish mineral, and hornblende with some quartz, and a fair amount of felspar, which seems commonly to be plagioclase; a little apatite, magnetite or hematite, and sphene. The mica (with perhaps the hornblende) appears to have been the first mineral to crystallize. The rock appears to me to belong to the mica-trap group, and to be a quartziferous kersantite.

(16.) A dark rather fissile rock, looking more like a bad slate than a true schist.

Microsc.—At first glance it seems very fragmental, but on careful examination I feel convinced that we are dealing with

a crushed crystalline rock, which has consisted chiefly of felspar and hornblende. There is a fair amount of apatite, and some of the hexagonal crystals appear to have escaped the crushing, or have been subsequently formed. I notice a few flakes of brown mica, and there are indications of iron oxides. Thus it is now a schistose rock, not of a highly metamorphic aspect, but has been made out of a diorite or a hornblende schist.

The "coarse dark-coloured porphyritic rock" from this series (see Section I., page 558, also No. 38, page 572), if I have rightly identified the specimen, is holocrystalline; and it appears to me to be a true granite. I may add in regard to this, "upper series," that, if I am right in my interpretation of (16), the specimens do not suggest to me the necessary existence of a wide gap between them and those of the lower series; that some appear to me igneous rocks, and that the others, if not igneous, belong to a highly crystalline group of rocks.

REMARKS.

I have had to speak with some hesitation as to the nature of certain of the above-described rocks. This is always needful in dealing with any series of very old rocks, especially when one has not had the opportunity of examining them in the field, because we are not yet sure of the significance of certain structures and their relation to the origin of the rock. But while I cannot positively assert that some of the rocks included in the Older Gneissic Group may not be rocks of igneous origin, to which a schistose structure has been imparted by subsequent pressure, I think it highly probable that they assumed their present character at a very remote period in the world's history, and may remark that this difficulty is one which frequently confronts us in examining the older Archæan series. But, while admitting this uncertainty, I observe in some of the specimens the structures which I have been accustomed to note as characteristic of the older gneisses, and was independently struck with the resemblance which some of them presented to specimens collected by myself in Canada and in N.W. Scotland, especially in the

case of (13), which is very like to a "quartzose gneiss," high in the Grenville series, shown to me by Sir W. Dawson in 1884, near Papineauville Station on the Ottawa river. Thus the series as a whole may safely be regarded as petrologically "homotaxial" with the middle part of the Canadian Laurentians.

2. SPECIMENS OF EGYPTIAN ROCKS SUBMITTED TO DR. B. J. HARRINGTON, F.R.S.C., F.G.S.

(1.) *Fragment of a granite sarcophagus from a tomb at Thebes, with very fine hieroglyphic inscription of Seti I.*—A granite consisting of quartz, orthoclase, plagioclase and a little microcline, hornblende, biotite, magnetite, and sphene.

(2.) *Granite fragment from old temple of the Pyramid of Kephren, Gizeh.*—A granite, in which, however, as in the case of No. 1, the plagioclase appears to be more abundant than the orthoclase. The other constituents are quartz, hornblende, biotite, apatite, magnetite, sphene, and a little microcline.

(3.) *Porphyritic rock from Biggeh* (*Upper Series*). This is holocrystalline rock, and appears to be a porphyritic granite. It is mainly made up of quartz and orthoclase, but contains a little plagioclase, microcline, and apatite. There is also some mica, which has suffered a good deal of decomposition, and a black opaque mineral, which is probably magnetite.

(4.) *Black bedded rock from Biggeh* (*Upper Series*).—This is probably an eruptive rock, and contains plagioclase, biotite, magnetite, apatite, a greenish mineral, which is apparently a decomposition product of the mica, a little quartz, etc. It may be called a mica-diorite.

(5.) *Black Statue of Pasht, Karnak.*—This rock is somewhat similar to No. 1, but contains a much larger proportion of plagioclase. It may be called a granite. The constituent minerals are quartz, orthoclase, plagioclase, biotite, hornblende, magnetite, apatite, sphene (?).

(6.) "*Spotted diorite af Assouan.*"—Consists mainly of plagioclase and hornblende, both of them more or less decomposed. A little magnetite and calcite are also present.

(7.) *Objects in Olivine Diabase, usually called Basalt.*—

These are olivine diabases. Both specimens are thoroughly crystalline, and consist of plagioclase, augite, magnetite, decomposed grains or occasionally crystals of olivine, apatite, etc. The rock in both cases contains porphyritically embedded crystals of plagioclase, which, judging from their optical characters, are probably anorthite.

(8.) *Statue of Kephren, Boulak Museum.*—Labradorite, of a white or light grey colour, with black hornblende, the latter arranged in contorted bands, giving a gneissose or bedded character to the rock. A rock of this kind occurs in the Upper Laurentian of Canada, and has been named gneissic anorthosite. It is a bedded rock occurring with ordinary gneiss and limestone, and so far as known is confined to the upper members of the Laurentian.

3. NOTES ON SOME SPECIMENS OF LIMESTONE FROM EGYPT AND SYRIA.

(A.) Eocene Limestone, Egypt, etc.

(1.) White limestone, casing of great pyramid, and sculptured inner wall of a tomb. Many tests of *Globigerina* and *Rotalia*, fragments of foraminiferal tests and coccoliths, texture very fine and uniform.

(2.) White limestone, Mokattam, differs from above in larger size of *globigerinæ*, and in having some *Textulariæ*.

(3.) Nummulitic limestone, Gizeh, Mokattam, composed of two species of Nummulites—viz., N. *gischensis* and N. *cornuspira*, with fragmental and calcite filling.

(4.) Limestone Turra quarries; fine white soft variety. Fine fragmental material, with *débris* of foraminifera and shells.

(5.) Colossus No. 2, front of S. propylon of Karnak. Fine-grained concretionary or oolitic limestone, with rod-like bodies, perhaps small spines of echinoderms.

(6.) Yellowish white building stone, Cairo, large *Globigerinæ*, *Textulariæ*, etc., in a chalky paste. Not unlike No. 2.

(7.) Eocene? limestone, Mount of Olives. Many Nummulites like N. *cornuspira*, with fragments of coral and spines of echinoids.

(B.) Cretaceous Limestones, Syria.

(1.) Royal quarries under Jerusalem, and white limestone of Jeremiah's grotto. "Malake" stone. Fine rounded transparent granules of calcite, with fragments of shells. Another specimen is wholly granular calcite, and is really a very fine-grained white marble.

(2.) Bedded limestone, Zion hill, Jerusalem; "Missie" stone. Granular limestone, with fragments of shells.

(3.) Soft greyish white chalky limestone of upper beds, Mount of Olives, etc. "Kakule" stone, a true foraminiferal chalk, with *Globigerina, Rotalia,* and *Textularia;* a few large *Rotaliæ* of the type of *R. Schroeteriana.*

(4.) Marly limestone, with *Baculites,* etc., Jericho road. Many small *Globigerina, Textularia,* and *Rotalia* in paste of coccoliths, etc.

(5.) Bituminous limestone, Neby Mousa. *Globigerina, Textularia,* and *Dentalina,* with filling of fragments and coccoliths. The filling is saturated with bitumen, which also fills the cavities of some of the foraminifera, while others are filled with clear calcite.

(6.) Fish beds, Hakel, Lebanon. Full of very minute foraminifera, embedded in coccolithic paste—*Orbulina, Globigerina,* etc. Some specimens have a few large globigerinæ and spines and small fish scales.

(7.) Fish beds, Sahel Alma. Very rich in foraminifera of larger size than those of Hakel, but of similar types. *Orbulina, Rotalia, Textularia, Globigerina,* etc. Also a few fish scales, and echinoid spines and coccoliths in the paste. A few green grains also appear, probably glauconite.

The beds of Hakel and Sahel Alma contain flattened Ammonites, with sculpture like that of A. Syriacus, as well as fossil fishes.

It would appear from the above observations that the richest foraminiferal limestones are those of the Upper Cretaceous, and Lower or Middle Eocene, while less oceanic and more shallow-water fossils predominate in the Lower and Middle Cretaceous and in the Upper Eocene.

III. FACTS RELATING TO THE MODERN DEPOSITS OF THE NILE.

1. Analyses by Dr. W. R. Johnson.

In January, 1845, a letter was read before the Academy of Natural Sciences, Philadelphia,[1] from Dr. Lepsius, relative to some observations of his on the former level of the Nile at Butir el Hagar, above Wadi-Halfa, from which it appears that the level of the inundation in the time of Usurtesen III. of the twelfth dynasty, was twenty-four English feet higher than at present. He also notices the fact observed by Dr. Leith Adams, and which I myself verified at Philæ, that above the First Cataract there are old margins of Nile mud at levels of ten to sixteen feet, and others as much as thirty-four to thirty-seven feet above the highest modern inundation. These facts show that an important lowering or widening of the passage at the cataract must have taken place in early historical times.

With the communication above referred to, Dr. Lepsius forwarded several specimens of Nile mud, some of which were analysed by the late Dr. Walter R. Johnson. Two of these are more especially important, namely, one from a bank thirty feet above the present level of the river at Korosco, and presumably of high antiquity, the other, recent Nile mud from the same locality. These analyses show (1st), the large amount of silicates in the Nile mud; (2nd), its great value as an agricultural soil; and (3rd), that in the older sediment there is a much larger quantity of carbonate of lime, indicating in all probability a greater rainfall and greater denudation than at present. This, it will be observed, coincides with the fact apparent in the recent borings as described by Prof. Judd, that the lower parts of the Delta deposits are richer in calcium carbonate than those nearer the surface, indicating a pluvial period before the modern era.

Johnson's remarks on those soils are so important that I give here considerable extracts from his report:—

[1] "Proc. Ac. Nat. Sci., Jan. 21, 184

(1.) *Earth of the Nile taken from the summit of hillocks at thirty feet above the present level of the River, about a mile above Korosco.*

"This earth is partly in powder and partly in lumps. In some of the latter, distinct traces of folia, or plies, marking an imperfect stratification, are to be seen. Along these seams fractures often occur. Throughout the lumps are to be observed innumerable cavities or spiracles of a tortuous form, giving the impression of having been produced by some species of vermes. Many of these are lined and some nearly filled up with carbonate of lime. Tubes of the same material are found in a separate state, and some plane surfaces are covered with it. The whole has a light spongy appearance and the resemblance is strengthened by the vermicular cavities, which remind one of the white tubes often found traversing masses of common sponge. Very fine micaceous particles are distributed pretty copiously through the masses, distinctly perceptible to the eye, and clearly exhibiting their forms under the lens. To the naked eye no ferruginous appearance is discernible, but the microscope shows innumerable points of a deep red colour. The mud appears to have been deposited at successive, but not very distant periods; while soft to have been penetrated by myriads of animalculæ; then dried and baked into a solid mass, imprisoning and destroying the animals, and forming a very porous soil, which, on subsequent exposure to water strongly impregnated with lime, received so much of the latter as to fill up many of the pores when the water came to be dried up."

The composition of this specimen is as follows:—

[The processes of analysis are then given in detail, and the result is stated as follows:—]

Water at 212°	4·20
Organic matter soluble in boiling water	2·30
Insoluble organic matter	2·15
Peroxide of iron	8·07
Alumina	2·64
Carbonic acid	5·55
Magnesia	2·06
Lime	7·11
Insoluble silicates	63·55
Loss	2·37
	100·00

(2.) *Specimen of the Earth newly deposited at Korosco, the 18th of August, 1844.*

"This specimen is entirely in powder, and of a colour very nearly approaching that of No. 1.

"Particles of mica are of a rather rare occurrence. A few minute fragments of straw or grass are detected; and by a gauze sieve, of which the meshes are 100 to the inch, and the space to the threads as $2\frac{1}{4}$ to 1 in diameter, making the open spaces $\frac{7}{1000}$ of an inch square, only 22 per cent. of this earth was arrested. A quantity of very fine fibrous or downy matter was also collected by the sieve. Portions of both the coarser and the finer parts of this soil are attracted by the magnet, 4-tenths of one per cent. being found in an average portion of it. On being washed, the coarser part is found to be a sand, composed of quartz, red and white, fragments of schorl, and garnets, of magnetic oxide of iron, a little mica, and a few fragments of tubes, such as are seen traversing the older portions of soil already examined. This composition indicates that this specimen has resulted from the decomposition of primitive rocks, and that their *débris* has been mixed with some portion of the anterior deposits along the river banks."

[Details are then given of the process of analysis, and the result is stated as follows :—]

Moisture				
Carbonic acid	3·70	per cent.		
	1·40			
Organic matter	3·70	viz.	Soluble	2·28
			Insoluble	1·42
Insoluble silicates	70·20			
Oxide of iron	8·76			
Alumina	6·55			
Lime	3·80			
Oxide of manganese	·30			
Magnesia	1·89			
Phosphate of lime	·15			
	100·45			

"The excess is here attributable in part to the peroxidation of the iron, which in the soil is partly in the state of magnetic oxide, and in part to the presumed slight amount of potash still adhering to the oxide and alumina."

Bringing together the results of the analysis of the ancient and that of the most recent soil, we find the following composition in 100 parts.

	Ancient Soil.		Recent Deposit.
Water	4·20		3·70
Soluble organic matter	2·30		2·28
Insoluble organic matter	2·15		1·42
Peroxide of iron	8·07		8·76
Alumina	2·64		6·55
Lime	7·11		3·80
Magnesia	2·06		1·89
Carbonic acid	5·55		1·40
Insoluble silicates	63·55		70·20
Loss	2·37	Ox. of Manganese	·30
		Phosphate of lime	·15
	100·00		100·45

The *loss* in the analysis of the ancient soil is attributed in part to the combined water, which no doubt existed in the peroxide of iron, and in part to the chloride of sodium and phosphate of alumina, of which some traces were observed, but of which time did not allow me to make a minute examination, or to repeat the analysis for the purpose of an exact determination of their proportion. The most striking difference between the ancient and the modern soils is to be found in the far higher proportion of carbonic acid, lime, and magnesia in the former, and the greater abundance of alumina and of insoluble silicates in the latter. The matter soluble in water is nearly the same for both, and the oxide of iron not widely different.[1]

2. Recent Borings in the Delta.

The following are Extracts from the Report of Professor Judd, F.R.S., on the recent borings in the Delta, with remarks of my own thereon, "Proceedings Royal Society," Nov. 1885, and *Nature*, Dec. 1885, Jan. 1887:—

"Neither of the borings made for the Royal Society, under the superintendence of the engineers attached to the army of occupation in Egypt, appears to have reached the rocky floor of the Nile valley; nor do the samples examined show any indication of an approach to such floor. What were at first

[1] A number of analyses of Nile sediment will be found in a memoir by the late Leonard Horner, F.R.S., "Philos. Transactions," 1855.

supposed to be pebbles in one of the samples from Tantah, proved on examination to be calcareous concretions ("race," or "kunkur"). Nevertheless, these borings appear to have reached a greater depth than all previous ones in the same district, with one or two exceptions. The deepest of the three borings now reported upon have been carried to seventy-three and eighty-four feet respectively.

"The samples from these borings, like those examined by Mr. Horner, show that the Delta-deposits all consist of admixtures, in various proportions, of brown sand and alluvial mud. I can find no evidence to support the suggestion made by Sir J. W. Dawson, F.R.S., from a hasty examination of the specimens, that 'at a depth of thirty or forty feet the alluvial mud rests on desert sand;' on the contrary, these borings, like those of older date, show that the deposits of the Nile valley consist of a succession of different beds, in some of which sand, and in others mud, forms the predominant constituent.

"The *sands*, when separated from the mud by washing, are found to be made up of two kinds of grains, the larger being perfectly rounded and polished, while the smaller, on the contrary, are often subangular or angular.

"The larger and well-rounded grains may be described as microscopic pebbles; their surfaces are most exquisitely smoothed and polished, and their forms are either globular or ellipsoidal. In size they vary greatly, being occasionally as large as a small pea. They only very occasionally exhibit traces of deposits of iron-oxides upon their surfaces.

"Embedding these grains in Canada balsam, and examining them by transmitted light, with the aid of the polariscope, we are in nearly all cases enabled to determine their mineral characters. The majority of the grains consist of colourless quartz, though occasionally rose-quartz, amethystine quartz, citrine, and smoky quartz also occur. This quartz exhibits unmistakable evidence of having been derived from granitic rocks; it is constantly seen to be traversed by bands of liquid and gas-cavities, and very frequently contains numerous black hair-like inclusions (rutile?). Much more rarely we detect grains of quartz which consist of aggregates of small crystals,

and are evidently derived from metamorphic rocks. With the pure quartz grains we find also a considerable number of rounded particles of red and brown jasper and of black Lydian stone, with fragments of silicified wood.

"But in addition to the different varieties of quartz, particles of felspar are found in considerable abundance among these large rounded grains. What is very remarkable about these felspar grains is the slight traces of kaolinization which they exhibit; they are, in fact, almost as fresh and unaltered as the grains of quartz themselves. Ordinary orthoclase and microcline are abundant, while plagioclase felspar is comparatively rare. With the rounded grains of quartz and felspar, a few examples of hornblende and other minerals, including jade, also occur.

"But far greater is the number of mineral species represented in the smaller subangular and angular sand-grains. In addition to the minerals already mentioned, I have recognised several varieties of mica, augite, enstatite, tourmaline, sphene, dichroite (cordierite), zircon, fluorspar, and magnetite.

"The *mud* is a much more difficult material to study the mineral characters of than the sand, owing to the extreme minuteness of its particles. It is a very striking fact, however, that kaolin, which constitutes the predominant ingredient of clays, appears to be almost absent from these Nile muds. Chips and flakes of quartz, felspar, mica, hornblende, and other minerals can be readily recognised; and it is often evident that the unaltered particles of such minerals make up the greater part, if not the whole mass, of the fine-grained deposits. The mineral particles are, of course, mingled with a larger or smaller proportion of organic particles. Frustules of *Diatomaceæ* occur in these muds, as was pointed out by Ehrenberg; but unless special precautions were observed in collecting the samples, it would be unsafe to draw any deductions from their presence."[1]

[1] The following, from a recent address of the President of the Royal Society, relates to the continuation of the borings:—

"The boring in the Delta of the Nile has been continued, by the favour of the War Office, under the able and zealous superintendence of Captain Dickinson, R.E. As I mentioned last year, the committee thought it

The statement in the second paragraph of the above extract is not quite in accordance with the sections given in the Report, which show as stated in Chap. VI., an increase in the amount of desert sand at about forty feet, especially in the Tantah boring; and below this, material rich in calcareous concretions and belonging apparently to the Pleistocene age. The borings have now penetrated much deeper, without reaching the Eocene or Cretaceous rock; but this was to be anticipated, since the Egyptian bay must have received much of the *débris* of the excavation of the Nile valley and its tributary wadys before the modern river deposit began.

When I was kindly permitted to see a portion of the borings in Cairo, in the early part of 1884, the work had extended to a depth of only about forty feet, and, at a depth of between thirty and forty feet, the boring rod, after passing through continuous Nile mud, had entered into quicksand consisting of polished and rounded grains of quartz and other hard minerals (desert sand), and the difficulties incident to this material had, for the time, arrested the operations. Feeling that this result was of the greatest geological significance, and learning that the increased difficulty of the work would demand additional funds, I wrote a letter to the President of the Royal Society, strongly advising the granting of an additional sum of money. I then believed, and still believe, that the quicksand marks the true base of the modern Delta alluvium, and corresponds with the similar sand which in certain parts of the Delta protrudes from beneath the fluviatile deposits. I did not, however, suppose that this sand rests on the rocky floor of the valley. On the contrary, as may be inferred from my short statement in the *Geological Magazine*, I anticipated that below the sand would be found the Pleistocene clays, marls, sands, and concretionary limestones of the "Isthmian" formation seen at El Guisr, on the Suez Canal,

best to concentrate their efforts on a single boring until rock should be reached, or else a stratum of such a character as to show that the alluvial or drifted deposit had been got through. This result has not at present been obtained. The boring at Zagazig reached the depth of 324ft., when the tube broke and stopped for the time further progress. It is, however, a matter of interest and importance to know that the drift or deposit extends to so great a depth."

and the equivalents of which appear rising from beneath the modern alluvium in several parts of the Nile valley, and were apparently reached by Figari Bey, in his boring operations. Further, there seemed to me in the colour and quality of the clay mixed with the lower samples which I saw at Cairo, indications of the approach to these deposits.

Though I have not seen the borings between forty and eighty-four feet, I venture to predict that if these can be separated from the mud and sand introduced from above, or if proper allowance be made for these, it will be found that these lower samples differ in quality and composition from the modern fluviatile deposit.

I have referred to the probability that the lower part of the Delta borings have penetrated the Pleistocene Isthmian deposit under the Nile mud. In support of this view, I may refer to Lartet's "Geology of Palestine," to Figari Bey and Horner, and to Fraas and Schweinfurth, all of whom recognise the occurrence of sand and Isthmian deposits under from thirty to forty feet, and in some places fifty feet of Nile mud.

The softness of the Nile waters and the minutely arenaceous character of the Nile mud, as well as the connection of this with its fertility, have been known from remote times, and Professor Judd has worked out many interesting points as to their details. With respect, however, to the causes and geological significance of these phenomena, the conclusions stated in his Report seem open to serious objections, which I could have wished to have had an opportunity to state before any authoritative publication had taken place.

I now propose to state some of these objections to the generalizations of the Report on the Nile borings with reference to the causes assigned for the comparative purity of the water of the Nile and the character of its sediment; viz., that the former is due to its flowing through a rainless country, and that the latter is derived from the decay of rocks in a rainless area of the tropics, and this produced, not by "chemical agencies," but by "mechanical forces," namely, the "unequal expansion" of the constituent minerals under the influence of heat and "the force of the wind."

It is scarcely necessary to premise, that neither the water nor the mud of the Nile are derived from the rainless area through which it flows in Egypt proper, but from the well-watered region of interior Africa. The White Nile, which carries scarcely any sediment, is a somewhat constant stream, draining a country of lakes, forests, and swamps. The Blue, or Dark, Nile and the Atbara drain the mountainous country of Abyssinia, deluged by heavy rains in the wet season; and it is these streams, loaded with mountain detritus, that supply the Nile with all its sediment, as the quantity of fresh material carried into it below the confluence of the Atbara is infinitesimally small. Thus both the water of the inundation and the material of the mud come from a country of copious rains, and where decay of rocks may be expected to go on under ordinary circumstances. In other words, the Nile originates in and derives its sediment from a well-watered region, and merely flows through a rainless district on its way to the sea. It is to be remarked in this connection, that in warm climates the sub-aërial disintegration of crystalline rocks takes place much more rapidly than under lower temperatures. Besides this, much of the material produced by disintegration of rock has, in the northern part of our continents, been removed in the glacial period, leaving bare, polished surfaces, which there has not been time since that period to erode.[1]

What, then, is the cause of the freedom from saline matter of the Nile water? Simply the fact, that it is derived from a country of siliceous and crystalline rocks. If, instead of comparing it with the water of the Thames and other rivers flowing through sedimentary rocks, it had been compared with that of the streams and lakes of the Scottish hills—certainly not a rainless district—this would have appeared at once. Dr. Hunt has described and assigned to its true cause a fact of the same kind in the case of the Ottawa, as compared with the St. Lawrence. The former, flowing mainly from a region of crystalline rocks, has little more than one-third of the amount

[1] Nordenskiold has referred to this in the "Cruise of the Vega," as have Hunt, Storer, and others in America. (See "Science," Feb., 1883.)

of saline matter found in the St. Lawrence, which drains principally a sedimentary country. The proportions in 10,000 parts are, in the Ottawa, ·6116, and in the St. Lawrence, 1·6055 of mineral matter in solution.[1]

But it may be asked, Why, in that case, is the Nile mud so deficient in kaolin? The answer is, that the current of the Nile is sufficient to wash out all the more finely comminuted kaolin, and carry it in its turbid waters to the sea. In connection with this, every voyager on the subsiding Nile must have noticed how the mud banks are constantly falling as they are undermined by the stream, their material being carried down to be re-deposited. This work must go on even more energetically in the rising Nile. Thus any given quantity of mud on its way from Abyssinia to the Delta is deposited and removed many times, or in other words, subjected to thousands of lixiviations, by which it is necessarily deprived of all its fine argillaceous material.

But the quantity of kaolin need not necessarily have been large. The mud is, as Judd has well shown, rich in undecomposed particles of felspar and other silicates, yet it came from the well-watered hills of Abyssinia. The cause of this is, that the older gneisses and schists do not kaolinize throughout in the manner of Cornish granites, but when decomposed so as to crumble readily to sand, still contain much of their more refractory felspar in a perfect state.

These facts are connected with the agricultural qualities of the Nile mud. If it were a clay largely composed of kaolin, it would be practically incapable of cultivation. If it were pure quartz sand, it would be hopelessly barren. It is an impalpable sand, highly absorbent of water, and crumbling down the instant it is wet; and it contains particles of silicates and of apatite derived from the parent rocks, and which, though unaltered when under water, when exposed to the action of carbonic acid in the soil, are slowly dissolved, yielding alkalis and phosphates.[2] Schweinfurth has admirably

[1] Logan's "Geology of Canada," 1863, p. 565.

[2] Bonney has found apatite in the microscopic examination of the crystalline rocks of Upper Egypt, and it occurs in similar rocks in other regions.

explained these properties in connection with the true origin of the sediment, in "Baedeker's Guide," a work in every traveller's hands.

As to the mechanical action of the heat of the sun on crystalline rocks, any one who examines the polished surfaces still retained by the oldest monuments of Upper Egypt, which have been exposed to this action for thousands of years, must be aware that nothing of this kind occurs. The only evidence that I could find of such action was the chipping of little circular discs from the surface of flint nodules exposed on the surface of the desert. Granitic rocks decay, however, in Egypt, as elsewhere, when they are exposed to moisture from the soil, or when, as at Alexandria, acted on by sea air and rain. In many places near Assouan I found, in a climate now at least rainless, or nearly so, that the gneiss and schists are chemically decomposed, and in a crumbling state to the depth of several feet, though no doubt only very partially kaolinized. This was undoubtedly due to the action of water and CO^2, either oozing through the ground or, more probably, applied at some former pluvial period.

Hague, in a paper on the decay of the Nile obelisk ("Science," vol. vi., No. 149), shows that moisture and frost are rapidly acting on its surface, and quotes Wigner as showing that the action of the weather at Alexandria had produced a slight effect on the part of the London obelisk which had been exposed above the sand; but at Alexandria there is moisture as well as saline air.

The above statements are, I think, sufficient to show that the water of the Nile must owe its purity to the same causes which apply to other streams originating in regions of abundant rain, and that Egypt has the exceptional advantage of being watered by a pure mountain stream, which the rainless character of its own climate merely preserves from being polluted by the drainage of the Cretaceous and Tertiary beds; and that its rich alluvial soil has not been produced by any exceptional mechanical action, but by the ordinary atmospheric agencies of denudation.

These conclusions are not altogether new. They will be

found to agree in the main with those of most geologists who have studied the valley of the Nile, and I could readily adduce in their support quotations more especially from Lartet, Fraas, and Schweinfurth. They are now presented in opposition to a theory which if novel does not seem to be warranted by the facts of the case, and to statements respecting the depth of the modern alluvium of the Delta, which leave out of account the well-known Pleistocene formation which underlies it.

I have been favoured by my friend Dr. Schweinfurth, of Cairo, with a specimen of the finest deposit of Nile water collected in a tank at Cairo, and obtained from the river near the bank. It is a hard, almost stony mass, very much finer in texture than the ordinary Nile mud, and a little lighter in colour. It is only slowly softened and diffused in water, and when so diffused in proper quantity, gives it precisely the appearance of the ordinary Nile water. A portion of it settles rapidly, and on microscopic examination is found to resemble the ordinary Nile mud in presenting comminuted particles of crystalline minerals, but of extreme fineness. The remainder continues in suspension for a long time, since a trace of turbidity remains in the water even after it has been kept still for thirty-six hours. The fine sediment held in suspension after some hours, is proved to be an impalpable powder, aggregating itself in flocculi and presenting no definite forms under the microscope. It has not yet been analysed, but I have no doubt from its character that it consists largely of kaolinous *débris* of rocks, perhaps with a small amount of organic matter. When dried on filtering paper it appears as a smooth pellicle, cracking and curling up at the edges when dry. The large volume of this impalpable matter, washed out of the Nile mud and finally carried off to sea, in my judgment accounts for the comparative absence of the finer *débris* of crystalline rocks in the latter. Yet even in the very fine silt which takes longest to settle, the microscope shows some remains of undecomposed silicates.

It is to be observed, however, that, as stated in the text, this material is all derived, not from the rainless district of

the Nile valley, which affords only wind-blown desert sand, but from the well-watered mountains of Abyssinia. In like manner, the proper Delta deposit is necessarily confined to the later modern period, the lower alluvial beds being the products of previous geographical and climatal conditions, and holding a larger amount of desert sand, as well as of material swept by aqueous agencies out of the Nile valley itself, and derived, not solely from the crystalline rocks of Abyssinia, but, in part at least, from the Cretaceous, Eocene, and Miocene formations of Middle and Lower Egypt.

IV. GEOLOGY OF PALESTINE.

Having given in some detail the results of my observations in Egypt, I may notice the corresponding rocks of Palestine, rather by way of comparison.

The crystalline rocks of the peninsula of Sinai, and extending thence northward on the Gulf of Akaba, and east of the Arabah valley, are known to me only by specimens and descriptions.[1] From these, I have no doubt that they represent lithologically the crystalline rocks of Egypt, and are probably of the same age. I regard the group of the Sinai range as Laurentian, and the associated intrusive granites and diorites, which seem however to be more massive than those at Assouan, as of similar age. In like manner, the bedded porphyries and schistose rocks which lap around the central nucleus of gneiss and granite, appear to be the equivalents of the second crystalline series of Assouan, and to be of Huronian age. The exposures of these rocks are, in Palestine, limited to the south-eastern portion of the country, eastward of the great Jordan valley fault.

It would seem that the earliest folding and elevation of the Eozoic rocks of Arabia, Egypt, and Palestine immediately succeeded the Laurentian, being even pre-Huronian; and that this consisted of two lines of folding, approximately S.E. and N.W., and meeting in the angle of the Sinai peninsula, along

[1] Bauerman, Lartet, Hull, etc.

with a third nearly parallel line, constituting the Arabian hills, and leaving between them the very ancient trough occupied by the Gulf of Suez. The much more recent fractures of the Jordan valley and Nile valley were parallel to these ancient lines of folding, and no doubt in some degree consequent on them.

In Palestine, as in Egypt, there is a great chronological hiatus between the crystalline rocks and the next sedimentary formation, which Hull has named the "Desert Sandstone," and which constitutes the lower member of the Nubian sandstone of Russegger, Lartet, and Zittell, the "Grès Monumental" of De Rosière. In Egypt, as we have seen, there are indications of a division of this sandstone into two formations; and this distinction seems more evident in the Sinaitic region and Palestine. More especially at Wady Nasb, as described by Bauerman and Hull, the lower sandstone is associated with a limestone whose fossils are distinctly carboniferous as determined by Tate and Sollas.[1] The species are *Syringopora ramulosa*, Goldf., *Zaphrentis sp. Feuestella*, allied to *F. plebia*, *Spirifer striatus*, Martin, *Productus pustulosus*, Phillips, or allied, *Orthis Michelini*, *Streptorhynchus crenistria*, *Rhodocrinus sp.*, etc. This assemblage is distinctly Carboniferous, and probably Lower Carboniferous, and, in connection with the *Lepidodendron* and *Sigillaria* found in the sandstones, and already referred to, furnishes conclusive evidence of the age of the deposit.

In lithological character, however, the sandstone is scarcely distinguishable from overlying beds, which conformably underlie the Cretaceous limestones, and are probably a true member of that formation; destitute, however, of fossils, except where they pass into the limestone above. These sandstones are remarkable for their bright colours, and are those of the ancient city and rock-cut tombs of Petra. Both the Desert sandstone and the Nubian sandstone may be regarded as products of the waste of the crystalline rocks, and as implying long-continued sub-aërial decay of those rocks. The upper member, however, is in all probability largely made up of *remanié débris* of the lower or Desert sandstone.

[1] "Quarterly Journal, Geol. Soc.," xxvii., Hull's Report, p. 49.

Next to these is the Cretaceous limestone formation, which, as we have already seen, is extensively distributed, and attains to a great thickness in Palestine; being, in fact, the most important formation of the country. Different members of this formation have been referred to in the text; and here I may merely summarize its divisions, and mention some of the more characteristic fossils.

It is not easy to give a classification of the Cretaceous rocks of Southern Palestine; but putting together my own observations with what I find in Lartet and Hull, and in Hudleston's memoir on the Geology of Palestine, I may venture to offer the following as at least approximate. The order is ascending :—

(1.) Nubian Sandstone, red and white. Maximum thickness probably 1,000 feet.
(2.) Hard Limestone and Dolomitic Limestone with marly beds. *Pterodonta, Nerinea, Ammonites, Ostreæ* of different species.
(3.) Variegated and white Limestone. *Ammonites, Turritellæ, Hippurites.*
(4.) Soft grey Limestones, with many and thick cherty bands.
(5.) Dark Limestones and calcareous Shales and bituminous Limestones. *Foraminifera* and fish scales, etc.
(6.) White chalky Limestone and marly and grey beds. *Ammonites Luynesi, Baculites anceps.*
Total thickness, probably 2,500 feet or more.

As to the equivalency of these beds, it would seem that the Nubian sandstone may be regarded as the equivalent of the lower greensand and gault elsewhere (Neocomian); while the limestones range from Cenomanian to Senonian.

In the Lebanon, the Nubian sandstone does not appear, though it is believed to be represented in Anti-Libanus, beyond the great fault. The order in the Lebanon mountains proper would seem to be as follows, in ascending order :—

(1.) Jurassic strata are not known on Lebanon proper; but at and near Megdel es Shems, a Druse village on the southern slope of Mount Hermon, beds occur holding *Rhynchonella lacunosa* and *Terebratula bissufarcinota*,—and a number of *Ammonites* of distinct Jurassic types, as *A. convolutus*, Schletheim, and *A. hecticus*, Reinecke. Other species are mentioned by Neumayr.
(2.) The Araja Limestones and Marls, with many marine fossils. Among them is *Cidaris glandarius*, the spines of which are the so-called fossil olives. These constitute the Glandarius Zone of Fraas, and are believed to be of Neocômian age.
(3.) Sandstones and Clays with lignite and fossil plants, also Marls and

coarse Limestones. *Trigonia Syriaca* and *Astarte Libanotica*, also *Ostreæ*. Above this are the Limestone, Marls, and Dolomites of the Gastropod and Cardium Zones of Fraas, and the Limestone Zone with *Ammonites* (*Ceratites*) *Syriacus*, and many other fossils. The whole of these beds are Cenomanian in age, and partly equivalent to the older Jerusalem Limestone, in Judea, and above the Nubian Sandstone.

(4.) The Lebanon Limestone; thick Limestones and Marls, with corals, shells, and fossil fishes, the Limestones often foraminiferal. The celebrated fossil fishes of Hakel belong to the upper part of this division. The Hippurite Limestone is characteristic of the lower part, and the fish beds of the upper. The whole may be regarded as Turonian in age. They correspond to the upper Limestones of Jerusalem.

(5.) Limestone with flints, Chalk, and Marl, with *Ananchytes* and *Terebratula carnea*. In the lower part is the fish-marl of Sahel Alma, which connects it with No. 4. This may be regarded as Senonian, and as equivalent to the Bituminous Limestones, etc., and fish beds of the Jericho road and the Upper Cretaceous beds of Jebel Attaka. Bitumen is said to occur in this series in the southern part of Cœle-Syria.[1]

Diener has very carefully worked up the succession in his recent memoir, and it was previously well studied and described by Oscar Fraas, whose sub-divisions are similar to those given above.

The results of Diener's work are thus summed up by a reviewer in *Nature*.

"Dr. Diener has worked out with great success the numerous lines of faulting and flexuring which the strata have undergone since their deposition, and which have been produced mainly during the Miocene epoch. Mount Hermon itself owes its position in a great degree to the elevation of its mass along the line of a great fault which coincides with its western base. Its beds of limestone, belonging to the age of the Lower Chalk of Europe, are disposed in the form of a low arch, the axis of which passes under the summit, and ranges in a north-north-east direction along the line of the heights of Anti-Lebanon. Other faults range along the southern and eastern flanks of the great dome-shaped mount, which has thus been bodily upheaved in respect of the bordering strata. There can be no question that the system of terrestrial disturbances along which the Syrian mountains have been fractured

[1] Diener, pp. 43–44.

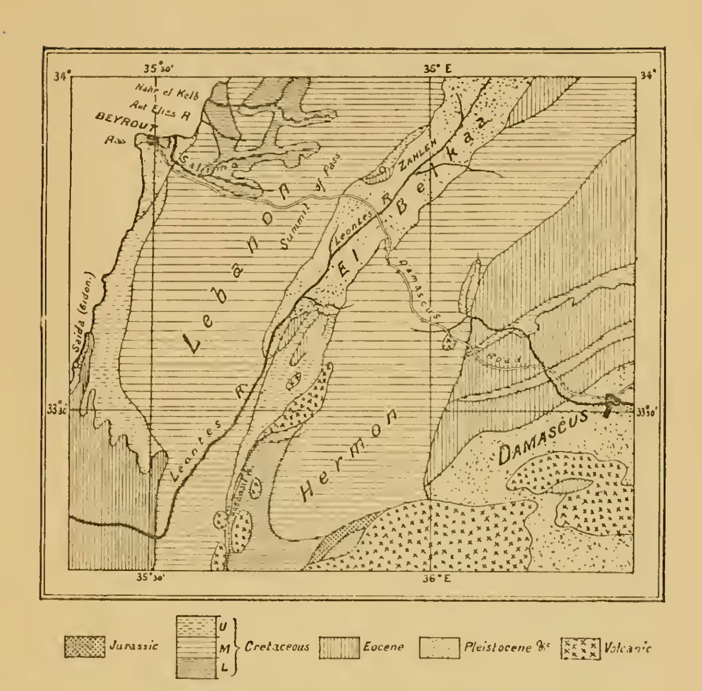


Fig. 9.—Geological Map of Northern Syria.
(In part after Diener.)

This map shows the structure of the country between Beyrout and Damascus, with the relation of this structure to Lebanon, Hermon, the Bekáa, and the sources of the Leontes and Hasbani; also the position of the little Jurassic outcrop on Hermon, and part of the great volcanic district south of Damascus, as well as the disposition of the Eocene and the different members of the Cretaceous.

and dislocated is the same as that which has given origin to the Jordan-Arabah depression; and amongst the lines of displacement traced out by Dr. Diener, we can have no difficulty in recognising that which is the actual prolongation of the leading fault of the Jordan valley. This great line of fracture and displacement appears to enter the valley of the Leontes (Litany) at the western base of Hermon, where a complete change of the stratification takes place on either side, and the 'Lebanon Limestone,' with the subordinate Lower Cretaceous beds, are thrown into a nearly vertical position, and brought into contact with horizontal strata of the Upper Chalk (Senonkreide). It may therefore be inferred that the great valley of Cœle-Syria (El Bekâa), separating the range of the Lebanon from that of Anti-Lebanon, owes its origin, in the first instance, to the same system of faults which has caused the depression of the Jordan valley, the original features having been modified by extensive denudation; and if we suppose that the primary line of fault reaches as far north as the Lake of Homs, in the valley of the Orontes, and as far south as the Gulf of Akabah, the distance through which this great line of fracture of the earth's crust will have been traced will amount to about 350 English miles."

The Nummulitic or Eocene formation, so largely represented in Egypt, occurs also in Palestine, but in a less degree of development. Nummulites are recorded from several places in the Judean range, and its extensions northward and southward; *e.g.*, in Carmel, at Samaria, near Jerusalem, and in the upper part of the Tih escarpment; and at Jebel Attaka, I saw beds full of Nummulites and other Eocene fossils overlying the thick Cretaceous limestones, but in much less mass than farther eastward in the Mokattam. Still, the formation is evidently distinct, though conformable, and I fancy that it will be found to be so in Palestine, though the occurrence there of the Eocene in isolated patches, and faulted in with the Cretaceous, produces an appearance of intermixture. For my own part, I failed to find any mixture of distinctively Eocene forms with the Cretaceous fossils, though I have no doubt that there may be beds of passage. According to Diener, the Nummuli-

tic Eocene occupies a large space in the desert east of Anti-Libanus and north of Damascus.

The flat coastal sandstones of the maritime plain of Palestine, which Hull calls the sandstones of Philistia, I should be inclined to correlate rather with the Miocene strata at the foot of the Eocene hills in the Isthmus, than with the Eocene itself. The evidence of fossils is wanting; but the flatness of these beds, their limitation to the maritime plain, and failure to conform to the dips and disturbances of the Cretaceo-Eocene deposits, seem to indicate a considerably later age, probably in the Later Miocene or even in the beginning of the Pliocene. The relations of the Miocene, both in Egypt and Syria, would seem to show that considerable elevation of the Eocene sea-bottom had occurred at the close of that period, but that further elevation with extensive faulting had occurred at the end of the Miocene.

The Pleistocene deposits of the coasts I have already referred to in the text, as well as the cavern deposits, and the marly terraces fringing the margin of the Dead Sea. To these I would with Hull refer the salt and gypsum deposits of Jebel Usdum, at the south end of the Dead Sea. They appear to be an exaggeration of the usual Dead Sea deposits, depending on local causes.

With respect to the volcanic rocks of the Hauran, of Galilee, and of the east side of the Dead Sea, these must be later than the Miocene, though, as explained in the text, the manner in which newer lava streams have run into ravines excavated in the older, shows that they are of different ages. In historic times there have been eruptions in the districts of Arabia adjoining the Gulf of Akaba.[1] The probability is, that the volcanic activity along the east side of the Jordan valley was a sequel to the great depression along that valley, and that it continued into the early modern age, though there is no record of any eruption within the historic period. The warm springs and sulphur deposits of the Dead Sea valley have no connection with these volcanic phenomena, except as secondary results. The sulphur concretions in the marls are of aqueous origin,

[1] Milne, J. A. S., vol. xxxi. p. 9.

and result from the decomposition of suph-hydric acid, in a manner quite usual where that acid is produced either by decay of organic matter in presence of gypsum, or as a residual result of volcanic action.

With reference to the migrations of animals and plants, there can be no question that the periods of Pleistocene depression, with cold and wet climate, must have promoted the migration of northern species into Palestine. In the continental periods of the Pliocene and early Modern, Palestine was as much a portion of Africa as of Asia, in so far as land and freshwater animals are concerned. The great Isthmian lake must at this period have been full of forms of African aquatic life, which could easily be transferred to the lakes and rivers of Palestine, more especially as the lines of migration of migratory birds passed over both regions.

V. FLINT IMPLEMENTS IN EGYPT.

Considerable attention has recently been given to the question of the existence of prehistoric man in Egypt, in consequence of the discovery of worked flints in various parts of the country. More especially I may refer to the papers of Sir John Lubbock, Mr. Fisher-Browne, Captain Burton, Mr. Greg, and General Pitt-Rivers, in the "Journal of the Anthropological Institute," and that of Professor Haynes in the "Journal of the American Academy of Sciences."

Egypt abounds in material for flint-working. Certain beds of the Eocene limestones hold numerous, and often large flint nodules; and, where these beds have been removed by denudation, the residual flints are widely scattered over the desert surfaces. There are also beds of gravel largely composed of entire and broken specimens of these flints. That the ancient Egyptians worked the flint nodules, and used flint arrows and knives, is well known; and it is also believed that flint flakes were used in the cutting of hieroglyphics on the softer limestones. Careful examination with the lens, of sculptured surfaces of limestone convinces me that the

hieroglyphics were usually scratched with sharp points rather than chiselled, and splinters of flint would be very suitable for this purpose. Bauerman has described[1] flint picks of triangular and trapeziform shape found in the mines worked by the Egyptians at Wady Meghara, in the Sinai peninsula, and states that the marks on the stone are such as these tools would make. The manufacture has been continued to the present time, flints for muskets, and also for strike-lights, to be carried, with steel and tinder of vegetable fibre, in the tobacco-pouch, being still commonly made and sold. This manufacture is carried on at Assiout, and also at the village of Kerdasseh, near the Gizeh pyramids.

It follows from this, that the occurrence of flint chips or flakes on the surface, and especially near "ateliers," village sites, or tombs, etc., carries with it no evidence of age, except such as may be afforded by the condition or forms of the flints; and the former is somewhat invalidated by the considerations that some flints weather more rapidly than others, and that under certain conditions of exposure weathering occurs very rapidly; while the latter is of little value, as the rudest forms of flints have been used for strike-lights and other purposes in the most modern times. Nor is it remarkable that worked flints are more common on the desert surfaces than on the alluvial plain, since it is on the former that the material for their manufacture is to be found, and on the latter they are likely to have been buried by recent deposits.

The well-known locality near Helouan forms a good example of the mode of occurrence of modern flint implements. At this place the worked flints, which are mostly of the form of long, slender flakes and pointed spicules, occur on the desert surface, or only under a little drifted sand, and the locality where they are found is evidently an old village site, as it has remains of foundations and tombs, worked blocks of limestone, and numerous fragments of burned brick, which occur along with the flakes. The character of the bricks would seem to indicate that the site was inhabited in the Roman time, or later. The flakes may have been made for use on the spot,

[1] "Journal of the Geological Society," vol. xxv.

perhaps in carving stone from the neighbouring quarries; or they may have been sold in Helouan or in Memphis, as they now are in Assiout and Cairo. Arrowheads are found at Helouan, but I saw none of these, unless, indeed, some of the pointed flakes might have been intended for this use. I afterwards saw good specimens in the Museum of the Society of Antiquaries in Edinburgh. It is worthy of remark that the desert near Helouan is less abundantly supplied with flint nodules than most other places, so that the material may have been brought from some distance. The flakes are usually much discoloured on the surface, many of them being of a kind of flint which blackens on weathering; but some of them of a different kind of flint are comparatively fresh in appearance. The principal locality is about half a mile south-west of the present town, and apparently on the line of an old track leading from the quarries to the river.

A different conclusion would be warranted if such worked flints were found in old deposits, anterior to the times of Egyptian civilization. A case of this kind seems to be furnished by the discovery, reported by General Pitt-Rivers, in the "Journal of the Anthropological Institute,"[1] of flint flakes in an old gravel at a place called by the natives Jebel Assart, at the mouth of the ravine of Bab-el-Molook, in which are the tombs of the kings, near Thebes. I have examined this place with some care, and am convinced of the antiquity of the gravel. It constitutes a stratified bed of considerable area, twenty-five feet in thickness, and with intercalated layers of sandy matter mixed with small stones. These layers are entirely different from the Nile mud, and are made up of fine *débris* of the Eocene rocks, with small stones and broken flints. They indicate more tranquil deposition, proceeding in the intervals of the gravel deposits and under water. General Pitt-Rivers refers to only one of these beds, but in the deeper sections three may be observed. The whole mass has been cemented by calcareous infiltration, so as to constitute a rock of some hardness. It is true it consists of the same materials now washed down the ravine by the torrents caused by

[1] No. 39, May, 1882.

winter rains, namely, partially-rounded masses of limestone and flints, whole and broken; but it must have been formed at a time when the ravine was steeper and less excavated than at present, and probably subject to more violent inundations, and when it must have carried its gravel into a larger Nile than the present, or possibly into an arm of the sea. It is, in all probability, one of the Pleistocene gravels of the valley, which belong to a period of subsidence indicated by similar beds in other places, and also by the raised beaches and the rocks covered with modern oysters and bored by lithodomous shells, which are seen near Cairo and at Gizeh, at the height of 200 feet above the sea.

Along a wady or ravine cut through the bed by the modern torrents, the ancient Egyptians have excavated tombs in the hard gravel. But, independently of this, a geologist would have little doubt as to its prehistoric age. The doubt here lies with respect to the flints. The bed is full of broken flints, as are the modern gravels carried down the ravine at present, and indeed all gravels formed by powerful torrents or surf-action in flint districts. These result from the violent impinging of stones on the flints, and therefore have all the characters of specimens broken by hand, except that they have no determinate forms. In this respect the broken flints found in these beds differ from those found at Helouan, or in the bone caves of the Lebanon, and resemble those which may be found in any bed of gravel formed by violent mechanical action. It is true, a few out of thousands of shapeless flakes might be likened to flat flakes formed by man; but the same proportion of such forms may be found in the modern *débris* of the torrents. The main point at issue in respect to these forms, is the importance attached to what is termed a "bulb of percussion," produced by a sharp blow striking off a flake. That this is usually an evidence of human agency may be admitted; but since it may be produced by the action of a water-driven stone, it cannot be regarded as an infallible proof, except when sustained by other evidences of the presence of man.

The specimens figured as from this bed by General Pitt-

Rivers are in no respect exceptions to this; and I dug out many similar ones from the same beds, but none which could with any certainty be assigned to human agency. I do not, of course, refer to those which he describes from tombs and from the surface, one of which is a finely-formed knife, with edges modified by pressure. Another, supposed to be for scraping or polishing shafts of spears, is like specimens of worn strike-lights from the pouches of modern Arabs. The singular annular nodules figured by General Pitt-Rivers, which are numerous in some of the limestones, of course have no connection with the worked flints; and the specimens which he figures from the surface, though some of them are no doubt ancient, are probably in part natural and in part from the little heaps left by Arabs and others in places where they have been shaping flints for muskets or for strike-lights. I obtained numbers of such surface specimens, evidently of more recent date than the old gravels above referred to, and whose mode of occurrence renders it impossible to decide as to their origin or antiquity. There is no foundation in fact for the statement that flint in Egypt has been imported from a distance for the manufacture of implements. Flint nodules occur in the limestones throughout the Nile valley, and are abundant in the *débris* derived from their waste; and though flakes and chips are numerous near tombs, quarries, and village sites, they are also very abundant in the places where the flint is found. I found no large hatchets of "palæolithic" form in Egypt, but purchased a spear-like weapon of polished slate, said to have been found in a tomb, and a beautiful little polished hatchet of jade, perforated for suspension as an ornament.

I may add that the hardened gravel and silt above referred to afforded no fossils, except those in limestone pebbles, and a few irregular root-like bodies in the finer bands, and which may have been aquatic plants, and would go to confirm the conclusion that the beds were deposited under water.

Since my visit to Egypt, Dr. Schweinfurth has examined some interesting deposits in the Wadys Sanour and Ourag.[1]

[1] "*Bulletin de L'Institut Egyptien,*" 1886.

Both these places are in the desert east of the Nile, the former east of Beni-Souef and the latter east of Kafr el Ayat, and rather more than fifty miles south-east of Cairo. At Wady Sanour the manufacture of flints for muskets was carried on on a large scale in modern times, to supply the armies of Mehemet Ali; but both at this place and Wady Ourag there are nuclei and implements of far more ancient date. Schweinfurth, however, refers these, and also the flakes of Helouan, to rude tribes which inhabited the eastern desert within the historic period of Egypt, though he believes them to be of great antiquity.

The beds affording the flints belong to the upper part of the Eocene Nummulitic formation. According to Schweinfurth, the same beds afford the rich deposits of flint now worked at the village of Abou-roache, near Kerdassé. They are, however, not equally rich in nodules in different localities. Hence the selection of the same places both in ancient and modern times for flint ateliers ; while these flinty beds are of course avoided by the ordinary quarryman.



INDEX.

Butler & Tanner, The Selwood Printing Works, Frome, and London.





